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No. 45

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CONTENTS (Continued)

MEETING OF NONALIGNED RADIO-TELEVISION EXPERTS DESCRIBED

Algiers EL MOUDJAHID in French 14, 15, 16 May 78

[Article by ALGERIAN PRESS SERVICE: "Meeting of the Committee of Radio-Television Experts from Nonaligned Countries"]

[14 May 78, pp 1, 2]

[Text] The group of experts of the cooperation committee of radio and television experts of nonaligned countries began yesterday morning [13 May 1978] and for 3 consecutive days is pursuing its efforts relating to the preparation of the international conference of radio broadcasters and of the international telecommunications congress to be held in 1979.

All the delegations of the 10 countries represented by the committee--Algeria, the Democratic People's Republic of Korea, Cuba, Guyana, India, Iraq, Nigeria, Yugoslavia, Zambia, and Tunisia--are participating in the work of the experts with the exception of that of Tunisia.

The opening session witnessed the speech of the director-general of the RTA [Algerian Radio and Television], Abderahmane Laghouati, who mentioned the unequal relations between the nonaligned countries and the developed countries in the field of telecommunications and broadcasting. Pursuing its work the conference proceeded in the afternoon to an examination of problems relative to sound broadcasting, telecating, and transmission by satellite. The various delegations made their viewpoints known on these problems one by one.

Let us specify that the group of experts was formed at the initiative of the cooperation committee of the organs of radio broadcasting of nonaligned countries and that the group is slated to prepare the world administrative conference of radiocommunications to be held in 1979.

This group would be the initiator and coordinator of all the measures and would also be entrusted with blocking out problems which will be the subject of the discussions of the 1979 conference whose solutions could insure a more

equitable and adequate distribution of the range of frequencies so that the nonaligned countries may enjoy the place that behooves them in this field.

The group is made up of the representatives of the radio broadcasting organs of Algeria (chairman of the group), the Democratic People's Republic of Korea, Cuba, Guyana, India, Iraq, Kenya, Nigeria, Tunisia, Yugoslavia, and Zambia.

In accordance with the interest of each of the regions, particular attention has to be earmarked, following the goals of the committee, to the examination of the possibilities of broadening long- and medium-wave ranges for the needs of radio broadcasting and to the highlighting of the danger presented by the tendency of the major powers to use a part of the short-wave band for radio transmission by satellite.

The nonaligned countries had rejected a proposal in this connection during the 1971 conference. The tendency of the large powers to use the band of frequencies assigned to short-wave tropical radio broadcasting for the transmission of their programs beyond their national borders was also discussed.

The study of the problems of accommodating satellites in the 12 GHZ-band [12 band], the study of the problems of linkage of satellites for program exchange purposes, and the study of problems of broadcasting by satellite radio programs slated for reception by inexpensive radio sets were additional topics.

Statement by the Director-General of the RTA

"You are slated to consider within the framework of the group of which you are a member a matter which is at the center of present international discussion and which opens up the entire question of economic, cultural, scientific, and political relations between the developed countries and the developing countries," Abderrahmane Laghouati, director-general of the Algerian Radio and Television, declared in his speech inaugurating the meetings of the committee of experts of radio and television stations of nonaligned countries.

"What is involved is to redefine the principles and methods of organization of these relations in accordance with the legitimate aspirations of states which for a long time have experienced the effects of an inequitable distribution of resources."

Earlier, Abderrahmane Laghouati opined that "the present meeting of the Committee undoubtedly reflects in the most remarkable manner the significant progress which the new cooperation established among our organs has accomplished within a relatively short space of time. This constitutes in truth a demonstration of our will, unanimously shared, to strive to realize effectively, methodically, and unambiguously the goals that we set in the action program approved at the initial conference of radio broadcasters of nonaligned countries held in October 1977 in Sarajevo and which we started to apply at the

time of the meeting of the cooperation committee held in March 1978 in Baghdad."

Discussing the resolutions adopted by the first conference, Abderrahmane Laghouati said that what is involved is "the elimination of the monopoly of information held by the developed countries.

"Such a stake," the speaker continued, "constitutes one of the themes of the movement of nonaligned countries, and the summit conferences of Algiers in 1973 and of Colombo in 1976 had requested that the appropriate institutions entrusted with dealing with problems in this field for the sake of equity, objectivity, and freedom be established. They were the intergovernmental information committee, the pool of press agencies, and the committee of cooperation of radio broadcasting organs."

First Come, First Served

Then, recalling the recent resolutions of the intergovernmental committee meeting in Havana and of the conference of national and international organs of information meeting in Stockholm, the director-general of the RTA continued to talk about the forthcoming Geneva conference on radiocommunications.

"Accordingly, it seems indispensable to us to try to present a united front at all international meetings where decisions of interest to us have to be made. One of the most important of those scheduled calls for careful preparation."

The speaker then sketched the history of the meetings of the ITU [International Telecommunications Union] beginning in 1959, the year when that specialized United Nations agency had only 96 members of which 25 were developing countries. Today it includes 154 members of which 107 countries are from the Third World.

"Until that date, relatively recent," Abderrahmane Laghouati continued, "the use of the range of frequencies which is a limited nautral resource belonging to all countries, small and large, was managed essentially according to principles safeguarding the interests of the developed countries. Indeed, the basic regulations which cover the operations of the ITU and which consist of international agreements, the rules of radiocommunications, and the advice of consultative committees were drawn up by the legislators and engineers of these countries. A special principle in effect at that time was the well known one of first come, first served."

Abderrahmane Laghouati recalled that since 1965, on the occasion of the celebration of the 100th anniversary of the ITU, the nonaligned countries have consistently struggled for the defense of all the new countries. And it is only in 1971 that the special administrative conference of space radiocommunications approved by a resolution the notion of "equitable use of space orbit resources," a motion made operational 2 years later by the adoption at Torremolinos of Article 33 of the convention now in effect.

"In terms of international law this was in fact a recognition of the quality of limited natural resource represented by the range of frequencies and the geo-stationary orbit," Abderrahmane Laghouati declared before stating:

"The year 1977 consecrated these principles in striking manner since the planning conference of the radio broadcasting service by satellites in the 12 GHZ-band approved a plan based on the equitable division of this band reflected by the assignment to each country of an orbital position and five television channels."

[15 May 78, p 1]

[Text] The conference of the group of radio broadcasting experts of non-aligned countries, under way at the Hotel El-Aurassi since Sunday [14 May 1978], is continuing.

The work yesterday morning related to the definition of a certain number of notions of radiocommunications.

Several experts among the delegations proposed amendments or revisions of specific articles of the international rules of radiocommunications.

Furthermore, questions of procedure relative to the preparation of the world administrative conference on radiocommunications which is slated to be held in Geneva in 1979 were discussed.

In the course of the meeting the Yugoslav and Algerian delegations raised points relating to the political aspect of stations highlighting the danger represented by some of these.

Indeed, several foreign radio broadcasting stations use territories belonging to nonaligned countries to broadcast programs directed against liberation movements or progressive organizations.

The activities of such stations are similar to veritable subversive operations and because of that constitute bases which are involved in activities of the same type as those of multinational corporations on the economic plane.

To request their ouster would be tantamount to effecting a soveriegn act commonly approved in the circle of nonaligned countries.

An irrefutable fact remains, however: The territories of the nonaligned countries must remain open to broadcasting stations of national liberation movements such as the PLO [Palestine Liberation Organization] or those of African countries, for they represent weapons in the hands of peoples in struggle.

In this respect a draft regulation was prepared by the group of experts for submission to the committee of cooperation of the radio broadcasting organs

nonaligned countries so that the matter may be brought up at the next world radiocommunications conference.

The Algiers meeting will have to be followed up with the approval of very important legislation for the redefinition of the rules which have determined for a long time the organization of the exploitation of the means of radio-communications.

These laws will have all the more impact as they have to be discussed at the national level by all the user services so that at the 1977 [sic--was 1979] conference a common front may be presented to the organs of the developed countries.

Yesterday afternoon the final draft was read at the plenary session and a resolution brought the session to an end.

The conference of the group of experts examined yesterday afternoon the draft recommendation prepared by a working committee.

This draft indicates that the movement of nonalignment which over the years has become an essential dimension of the system of international relations has stressed among the countries and international organs concerned the urgency for a basic revision of the control and explanation mechanisms of resources in fields as numerous as trade and commerce, finance and money, and science and technology. In so doing it has succeeded in raising in concrete terms the matter of inequities and has helped at the same time to highlight the most appropriate solutions to solve them.

The problem of the division of frequency bands, a natural resource which for a long time fell into the private domain of developed countries, is raised today in the same manner. It is slated to be treated from the same viewpoint--in other words, taking into account the interests of developing countries.

It is not inappropriate to note the dialectic existing between the dominant position occupied by the developed countries in the use of the range of frequencies and the monopoly available to them in the planning, implementation, and distribution of information.

The conferences of nonaligned countries have often highlighted, notably during the summit meetings of Algiers and Colombo, the need to challenge that monopoly by the initiation of an organic process striving to develop cooperation among the nonaligned countries in the field of information. The process initiated by the establishment of an intergovernmental committee was accomplished thereafter by the formation of a pool of press agencies and by a cooperation committee of radio broadcasting organs. The discussion that these various institutions initiated around the question of monopoly and the abusive monopolization of frequency bands reflects the same concern. The radio

broadcasting organs of developed countries continue to have as their goal to propagate through their powerful transmission facilities political messages directed essentially against the movement of progress for the peoples and the cause of liberation of nations.

Linking the two parts involved stems from an over-all vision, all of it oriented toward the acquisition of material goods and [control of] the political instruments of independence and progress.

The preparation of the world administrative conference of radiocommunications cannot ignore the fundamental complementarity between the two claims.

Too, the group of experts has strived to do a job connected with the technical aspect assumed by these demands taking into account the final goal which is the aggravation of the monopoly of information and of the resources that serve to support it.

These technical provisions concern notably the long waves, the hectometric waves, tropical radio broadcasting, the decametric bands, and the metric waves.

Finally, in their recommendations the committee secretaries highlighed the problems of radio broadcasting stations located outside national territories.

[16 May 78, p 3]

[Text] The conference of the group of radio broadcasting experts of non-aligned countries came to an end on Sunday evening at the Hotel El-Aurassi following 2 days of meetings. The participants approved the following resolution:

[Text of resolution]

The group of experts of the radio broadcasting organs of nonaligned countries, meeting on 13 and 14 May 1978 in Algiers to examine the problem of the distribution of frequency bands in view of the holding in 1979 of the world administrative conference of radiocommunications;

Considering that the recommendations which they elaborated at the conclusion of their discussions are constructive, that the document approved reflects the laudable efforts deployed for the sake of a greater coordination of the actions of the radio broadcasting organs of nonaligned countries;

Considering that the working climate which prevailed at that meeting as well as the unquestionable competence which has manifested itself have contributed greatly to the eminently fruitful nature of the results obtained;

Considering that the discussions and exchanges of viewpoint that they have had evidenced the close link existing among them in the resolve of the nonaligned countries to establish an equitable new order of frequency bands;

is of the opinion that an important stage has just been concluded in the materialization of the legitimate aspirations of the radio broadcasting organs of nonaligned countries and that exact data have made possible the elaboration of justified proposals on numerous matters;

Reaffirms its desire to infuse strong motivation into the activities of organs in specialized international institutions and to guarantee in them their appropriate representation slated to be different from the policy of the "fait accompli" practiced for a long time now;

Calls attention to the harmful activity of foreign broadcasting stations located outside national borders and proposes in this context that the nonaligned countries pursue their efforts to eliminate all colonial sequels and to prevent all neocolonial initiatives;

Renews the expression of its active solidarity with the radio-broadcasting organs and liberation movements and demands the right of countries still under foreign domination to an equitable access to frequency bands;

Declares itself ready to place its experience and skills at the service of scientific progress which the peoples of nonaligned countries are entitled to expect will lead to their own advancement.

2662
CSO: 5500

BRIEFS

ALGERIAN-SOUTH YEMENI COOPERATION--At the conclusion of the official visit in Algeria from 10 to 15 May 1978 of Mahmud 'Abdallah 'Ushaysh, minister of communications of the People's Democratic Republic of Yemen, a joint communique was released in Algiers on Monday [15 May 1978]. In the course of the meeting which was held in the office of the Ministry of Posts and Telecommunications, the ministers took cognizance of their complete identity of viewpoints regarding cooperation between the two countries in the field of posts and telecommunications, dynamic factors for reinforcing the bonds between the two countries, of the fraternity existing between the two peoples, and of mutual aid between the two revolutions. The methods used for the application of the directives of the top leaders of the two countries regarding the putting into place of a satellite land communications station at Aden were drawn up, the Algerian-Yemeni communique notes, adding that assistance in the postal field was also approved. Furthermore, Mohamed Zerguini [Algerian Minister of Communications] gave a favorable answer to the request of his Yemeni opposite number to have cadres and technicians of the People's Democratic Republic of Yemen come and acquire advanced professional training in Algeria at the Institute of Telecommunications of Oran and at the Central Training School of Posts and Financial Services. [Text] [Algiers EL MOUDJAHID in French 16 May 78 p 1] 2662

SPAIN-CUBA LINK--On the 30th of this month the inauguration will take place in the Cuba-USSR Protocol Salon of two telephone circuits between Cuba and Spain by means of the agreement established between the Ministry of Communications' EMTELCUBA (Cuba Telephone Enterprise) and the National Telephone Company of Spain. Communications between Cuba and Spain, up to the present, had taken place by shortwave and the circuits had been operated manually. The two new direct circuits are characterized by a satellite link through the Intersputnik system to Poland where they will then be conveyed overland to Madrid. They are distinguished by being the first international telephone circuits to operate in a semiautomatic manner in our country. All of this will be reflected in better service to the user, more rapid connection of calls, and better quality because it will be via satellite. The equipment which makes this semiautomatic operation possible was installed with the technical cooperation of the National Telephone Company of Spain. [Text] [Havana GRANMA in Spanish 27 May 78 p 3] 9117

CSO: 5500

COMPUTER INDUSTRY FACES TWO CHALLENGES

Canaberra THE AUSTRALIAN in English 26 Apr 78 p 14

[Text]

THE AUSTRALIAN'S annual computer industry survey this year looks at an industry meeting the twin challenges of a major structural change and a shortage of trained people.

For the first time in its brief history the computer industry is moving away from the massive computer toward small, even personal, models. The household computer is no longer a dream, it is fast becoming a necessity.

In business the small business computer has emerged as a separate class of machine and moved the power of electronic data processing into a whole new area. Today there are very few organisations that could not afford to employ a computer, often in place of the entire office clerical staff.

At the other end of the business scale the big organisations can now get three or four times the computing power at the same dollar cost they paid five years ago for inferior equipment.

Coupled with the reduction in mainframe costs there has been a massive increase in distributed computer power, a dramatic leap in networking ability and a reduction in costs. For a country like Australia ideally suited to widespread data transmission all this would seem to be exciting and to provide hopes for the future.

Sadly, all is not well. There is a national shortage of properly trained personnel to operate these advanced systems, software costs have taken-off and the line charges levied on progress by Telecom Australia have been little short of penal.

But notwithstanding all that there are signs that the computer industry will continue growing at much the same rate as it has in the past. We still import the trained people we need from England, we refuse to train our own, the hardware prices will continue to fall and managements are showing signs of accepting reasonable rather than perfect software.

CSO: 5500

REGULATION ON USING RADIO BROADCASTING STATIONS FOR TV TRANSMITTING

Belgrade SLUZBENI LIST SFRJ in Serbo-Croatian No 8, 17 Feb 78 pp 201-220

[Text] Article 1

This regulation establishes the frequency ranges and channels for broadcasting black and white television and color television (hence "television") and prescribes minimum values for reception of the signal and its protection, emission width and the technical characteristics of the transmitter and transformer of such emissions, in order to insure for other radio services and broadcasters of black and white television (hence "black and white television") and broadcasters of color television (hence "color television") undisturbed reception.

Article 2

The rules contained in this regulation pertain to all carriers having the right to transmit television, as well as to all producers and importers of transmitters and transformers for such broadcasts.

Article 3

The terms listed below have, within the content of this regulation, the following meanings:

1. Color television signal is the signal containing the color picture information which is obtained through its analysis.

2. Color video signal is the signal containing all the basic material necessary for the synthesis of the color picture: brightness signal, color signal, suppression impulse, synchronization signal, etc.

3. The brightness signal is the signal characterizing brightness of the picture.

4. Video frequencies are the frequencies of the spectral component of the video signal.

5. Line frequency (horizontal frequency) is the number of lines per second during the analysis or reproduction of the television picture.

6. The auxiliary color carrier is placed inside the frequency range of the brightness signal which is modulated in such way as to give the color signal.

7. The differential signal amplification is the difference in amplification at the various brightness levels.

8. Differential signal phase is the difference in the phase position at various brightness levels.

9. The interfering signal is the unwanted signal which appears during reception in addition to the useful signal.

10. Normal frequency movement is that movement during which the difference between the nominal frequencies of the picture carrier is a whole multiple of 1/12 of the line frequency, during which the exactitude of the frequency carrier is ± 500 Hz.

11. Precise frequency movement is that movement during which the difference between the nominal frequencies of the picture carrier is a whole multiple of 1/12 of the line frequency, during which the exactitude of the frequency is ± 1 Hz.

12. A television transmitter is an amplitude modulated picture transmitter with a partially suppressed lower sideband, and a frequency modulated tone transmitter. If a deviation exists, it is considered to be an integral part of the television transmitter.

13. A television transformer is a joint group of switches (entering amplifier, oscillators, mixers, interfrequency amplifiers, exit amplifier, regulating-switches and other switches) through which it is possible to transmit a television signal that was received on one channel through another channel.

14. The power of the picture transmitter is the effective expressed power (E.R.P) during the synchronization impulse (peak power), while the power of the tone transmitter is the value of the power of the unmodulated carrier.

15. The protection of the useful television signal is the relationship between the useful and interfering signals as they enter the television receiver.

16. The artificial antenna is the armored load attached to the transmitter for measuring purposes, and it replaces the real antenna.

17. Parasite oscillations are those oscillations whose frequency is outside the necessary width of the emission, and whose level may be decreased without influencing the transmittal of useful information.

18. The equivalent radiating power of the picture transmitter with closed doors is the power of the auxiliary transmitter which feeds the half-wave dipole instead of the picture transmitter and which, at any place of reception of the signal of the television transmitter, creates an electromagnetic field of the same power as a transmitter with closed doors and a well-armored artificial antenna.

II. Frequency Ranges, Channels and Frequency Exactitude

Article 4

Television transmitters and transformers which operate in the VHF (range I) frequency area utilize a frequency range of 47 to 68 MHz.

Article 5

The frequency range of 47 to 68 MHz contains three channels with frequency carriers for picture and tone, as follows:

Key:
1. Channel
2. Frequency range (MHz)
3. Picture carrier frequency (MHz)
4. Tone carrier frequency (MHz)
5. do = to

1) Kanal	2) Opseg frekvencije (MHz)	3) Noseća frekvencija slike (MHz)	4) Noseća frekvencija tona (MHz)
1	2	3	4
2	47 do 54	48,25	54,75
3	54 do 61	55,25	60,75
4	61 do 68	62,25	67,75

Article 6

Television transmitters and transformers which operate in the VHF (range III) frequency area utilize a frequency range of 174 to 230 MHz.

Article 7

The frequency range of 174 to 230 MHz contains eight channels with frequency carriers for pictures and tone, as follows:

Key:

1. Channel
2. Frequency range (MHz)
3. Picture carrier frequency (MHz)
4. Tone carrier frequency (MHz)
5. do = to

1) Kanal	2) Opseg frekvencije (MHz)	3) Noseća frekvencija slike (MHz)	4) Noseća frekvencija tona (MHz)
1	2	3	4
5	174 (5) do 181	175,25	180,75
6	181 do 188	182,25	187,75
7	188 do 195	189,25	194,75
8	195 do 202	196,25	201,75
9	202 do 209	203,25	208,75
10	209 do 216	210,25	215,75
11	216 do 223	217,25	222,75
12	223 do 230	224,25	229,75

Article 8

Television transmitters and transformers which operate in the UHF (range IV) frequency area utilize a frequency range from 470 to 582 MHz.

Article 9

The frequency range from 470 to 582 MHz contains 14 channels with frequency carriers for picture and tone, as follows:

Key:

1. Channel
2. Frequency range (MHz)
3. Picture carrier frequency(MHz)
4. Tone carrier frequency (MHz)
5. do = to

1) Kanal	2) Opseg frekvencije (MHz)	3) Noseća frekvencija slike (MHz)	4) Noseća frekvencija tona (MHz)
1	2	3	4
21	470 do 478	471,25	476,75
22	478 do 486	479,25	484,75
23	486 do 494	487,25	492,75
24	494 do 502	495,25	500,75
25	502 do 510	503,25	508,75
26	510 do 518	511,25	516,75
27	518 do 526	519,25	524,75
28	526 do 534	527,25	532,75
29	534 do 542	535,25	540,75
30	542 do 550	543,25	548,75
31	550 do 558	551,25	556,75
32	558 do 566	559,25	564,75
33	566 do 574	567,25	572,75
34	574 do 582	575,25	580,75

Article 10

Television transmitters and transformers that work in the UHF (range V) frequency area utilize a frequency range from 582 to 862 MHz.

Article 11

The frequency range from 582 to 862 MHz contains 35 channels with frequency carriers for picture and tone, as follows:

(Key and table on next page)

Key:

1. Channel
2. Frequency range (MHz)
3. Picture carrier frequency (MHz)
4. Tone carrier frequency (MHz)
5. do = to

1) Kanal	2) Opseg frekvencije (MHz)	3) Noseća frekvencija slike (MHz)	4) Noseća frekvencija tona (MHz)
1	2	3	4
35	582 do 590	583,25	588,75
36	590 do 598	591,25	596,75
37	598 do 606	599,25	604,75
38	606 do 614	607,25	612,75
39	614 do 622	615,25	620,75
40	622 do 630	623,25	628,75
41	630 do 638	631,25	636,75
42	638 do 646	639,25	644,75
43	646 do 654	647,25	652,75
44	654 do 662	655,25	660,75
45	662 do 670	663,25	668,75
46	670 do 678	671,25	676,75
47	678 do 686	679,25	684,75
48	686 do 694	687,25	692,75
49	694 do 702	695,25	700,75
50	702 do 710	703,25	708,75
51	710 do 718	711,25	716,75
52	718 do 726	719,25	724,75
53	726 do 734	727,25	732,75
54	734 do 742	735,25	740,75
55	742 do 750	743,25	748,75
56	750 do 758	751,25	756,75
57	758 do 766	759,25	764,75
58	766 do 774	767,25	772,75
59	774 do 782	775,25	780,75
60	782 do 790	783,25	788,75
61	790 do 798	791,25	796,75
62	798 do 806	799,25	804,75
63	806 do 814	807,25	812,75
64	814 do 822	815,25	820,75
65	822 do 830	823,25	828,75
66	830 do 838	831,25	836,75
67	838 do 846	839,25	844,75
68	846 do 854	847,25	852,75
69	854 do 862	855,25	860,75

Article 12

For basic television transmitters with maximum radiation power (E.R.P.) of picture transmitters higher than 1 kW in the VHF frequency area, or 10 kW in the UHF frequency area, the separation of radio channels according to locations is established by the final document of the European VHF/UHF radio-diffusion conference held in Stockholm in 1961.

Article 13

For a supplementary televsion transmitters and transformers, with a maximum radiation power (E.R.P.) of less than 1 kW in the VHF frequency area, or 10 kW in the UHF frequency area, the separation of channels according to locations is accomplished in accordance with the plan on separation and utilization of frequencies in Yugoslavia.

Article 14

In order to diminish mutual interference when working in the same channel, the basic transmitters of picture and tone must work with normal-frequency movement. For television picture transmitters the normal movement is established by the final document of the European VHF/UHF radio-diffusion conference.

Article 15

Television transmitters must work with precise-frequency movement on the same channel if mutual interference should appear in the buffer zone as a consequence of deviation from the planned strengths of the electromagnetic fields.

Television transformers must work with normal frequency movement in the same channel if interferences are foreseen during the planning stage or if mutual interferences appear in the buffer zone as a result of deviating from the planned strengths of the electromagnetic fields.

The holders of the right to manage radio diffusion television transmissions will, in the event of interferences outlined in paragraphs 1 and 2 of this article, agree upon the frequency movement necessary to remove the interference.

Article 16

The frequency movement for the picture and tone transmitters is, as a rule, the same.

Article 17

The frequency tolerance for the television picture signal is:

1. for normal movement ± 500 Hz
2. for precise movement ± 1 Hz

The exactitude of the horizontal frequency during utilization of normal or precise movement must be greater than $\pm 10^{-6}$

Article 18

The maximum frequency deviation during tone modulation may not exceed ± 50kHz.

Article 19

The difference between the central frequency of the FM tone signal during 100-percent modulation (± 50 kHz) and that of central frequency without modulation may not exceed ± 200 Hz.

III. Technical Characteristics of the Television System

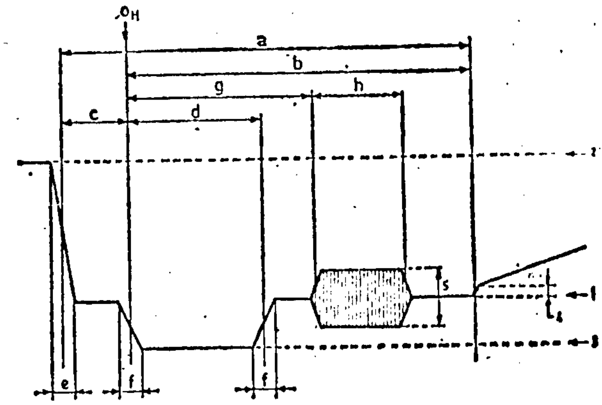
Article 20

For television in the VHF frequency area (ranges I and III) the television norm B (CCIR) is used; for the UHF frequency area (ranges IV and V) the television norm G (CCIR) is used.

The basic characteristics of systems B and G are:

Number	Characteristic	Value
1.	Number of lines per picture	625
2.	Frequency of half pictures, vertical frequency (number of half pictures/second)	50
3.	Separation	2:1
4.	Picture frequency (number of pictures/second)	25
5.	Line frequency, horizontal frequency (number of lines/second and tolerances for unsynchronized working:	
	--for black & white television	15625 Hz ± 0.02 percent
	--for color television	15625 Hz ± 0.0001 percent
6.	Nominal levels of the video signal according to picture No 1 in percentage:	
	--level of synchronization (referential level)	0
	--level of suppression	30
	--level of whiteness	100
7.	Picture proportion	4/3
8.	Line analysis from left to right half-picture analysis from top to bottom	
9.	System capable of working independently of feeding frequency	

10.	Assumed gamma cathode tubes in receiver for precorrection of black and white signal	2.8 ± 0.3
11.	Nominal width of video range (MHz)	5



1) 1 — razina potiskivanja
2) 2 — razina bijeloga
3) 3 — razina sinhronizacije
4 — postolje 4)
5 — referentni nosilac 5)
(vrh-vrh)

6) Slika br. 1

Key:

1. level of suppression
2. level of whiteness
3. level of synchronization
4. foundation
5. referential carrier (peak to peak)
6. illustration 1.

Article 21

The characteristics of the signal for horizontal synchronization for systems B and G (illustration 1) are:

Label	Characteristic	Value
	Nominal duration of line (μs)	64
a.	Duration of suppression impulse (μs)	12 ± 0.3
b.	Interval between horizontal starting time O_H and the last line border impulse for suppression (μs)	10.5
c.	Duration of initial step (μs)	1.5 ± 0.3
d.	Duration of synchronization impulse (μs)	4.7 ± 0.2
e.	Increase time (10 to 90 percent) of the border of suppression line impulse (μs)	0.3 ± 0.1
f.	Increase time (10 to 90 percent) of the line synchronization impulse (μs)	0.2 ± 0.1

The values in the table in paragraph one of this article are values between points at half amplitude of the corresponding impulse borders.

Article 22

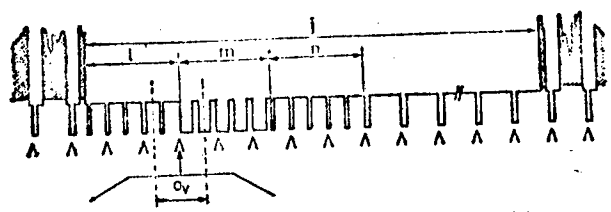
The characteristics of the vertical synchronization signal for systems B and G (illustration 2a, 2b and 2c) are:

Label	Characteristic	Value
	Duration of half-picture (μs)	20

j.	Duration of suppression interval for half-pictures (for H and "a" the regulations outlined in article 21 apply)	25 H + a
	Increase time (10 to 90 percent) of the vertical suppression impulse (μs)	0.3 ± 0.1
l.	Duration of the first procession of equalization impulse	2.5 H
m.	Duration of synchronization impulse procession	2.5 H
n.	Duration of the second procession of equalization impulse	2.5 H
p.	Duration of equalization impulse (μs)	2.35 ± 0.1
q.	Duration of vertical synchronization impulse (μs)	27.3
r.	Interval between vertical synchronization impulses (μs)	4.7 ± 0.2
s.	Time of increase (10 to 90 percent) of the synchronization impulse and of equalization impulse (μs)	0.2 ± 0.1

The values in the table in paragraph one of this article are values between points at half amplitude of the corresponding impulse borders.

1) *A. Signal na početku svake prve poluslike*



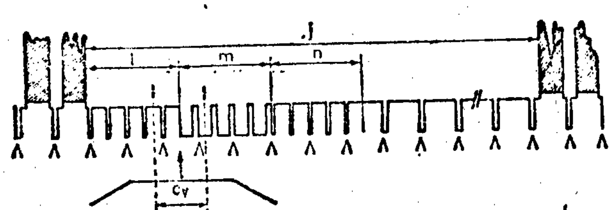
2) Druga poluslika Vidi sliku br. 2c Prva poluslika.

3) Slika br. 2a

Key:

1. A. Signal at beginning of each first half-picture
2. Second half-picture, see illustration 2c first half-picture
3. Illustration 2 a

1) *B. Signal na početku svake druge poluslike*



2) Prva poluslika Vidi sliku br. 2c Druga poluslika

3) Slika br. 2b

Key:

1. B. Signal at beginning of each second half-picture
2. First half-picture, see illustration 2 c second half-picture
3. Illustration 2b

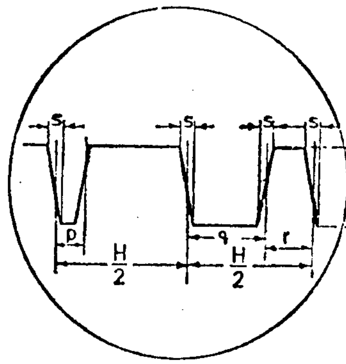
Remarks on illustrations 2a and 2b:

1. ΛΛΛ Indicates uninterrupted procession of borders of line synchronization impulses during the vertical suppression impulse.

2. At the beginning of each first half picture, the border of the vertical synchronization impulse O_V corresponds to the border of the horizontal synchronization impulse

3. At the beginning of each second half-picture the border of the vertical synchronization impulse O_V falls between the line synchronization impulses.

1) C. Detalji sinhroimpulsa i impulsa za izjednačenje



3) Slika br. 2c

Key:

1. C. Details of synchronization impulse and equalization impulse
2. Suppression level
3. Illustration 2c
4. Synchronization level

Lines 16 and 22 or 329 to 334 during the suppression impulse may be used for special purposes. These lines are used for:

	Line
1. Transmission of data	16 (329)
2. Transmission of international testing signals	17 (330) and 18 (331)
3. Transmission of national signals	19 (332), 20 (333) and 21 (334)
4. Measuring noise	22 (335)

Lines 19 and 332 are used to transmit the exact time and frequency.

Article 23

The characteristics of the color video signal (PAL system) are:

Key: [to chart on next page]

1. Number 2. Characteristic 3. Value 4. Coordinates of primary colors
5. Red x + 0.64 y = 0.33
Green x = 0.29 y = 0.60
Blue x = 0.15 y = 0.06
6. Color coordinates for equal primary signals $E^3{}_R = E^1{}_G = E^1{}_B$
7. White x = 0.313 y = 0.329
8. Assumed gamma cathode tubes of receiver for previous correction of primary signal 2.8; 9. Brightness signal; 10. Are gamma corrected signals; 11. Color signals; 12. Weakening of the color signals; 13. Multiplication of the complex color video signal; 14. Where is:; 15. $E^1{}_Y$ (see point 4 of this table); 16. $E^1{}_U$ and $E^1{}_V$ (see point 5 of this table); 17. F_{SC} (see point 9 of this table) Sign of component $E^1{}_V$ is the same as that of the auxiliary carrier--it changes from line to line (see point 14 of this table and illustration 3); 18. Type of modulation of the auxiliary carrier of the color signal: amplitude modulation with suppressed carrier, two auxiliary carriers squared.

19. Frequency of auxiliary carrier:
--nominal value and tolerance (Hz)
[?4.433] 618.75 ± 5.0
--relationship between the frequency of the auxiliary carrier f_{sc} and line frequency f_H $F_{sc}=(1135/4 + 1/625)f_H$
20. Nominal frequency spectrum of the modulated auxiliary carrier (kHz)
$f_{sc} \begin{cases} +570 \\ -1300 \end{cases}$

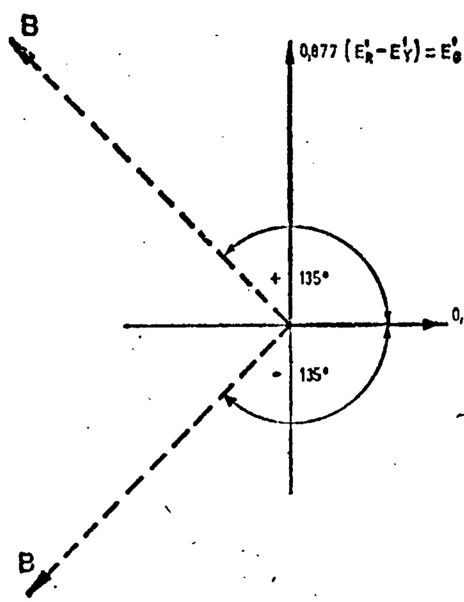
21. Amplitude of the modulated auxiliary carrier G $E^1{}_U2 + E^1{}_V2$
22. Color synchronization with referential carriers:
23.--beginning of referential carrier (illustration 1) (s)5.6± 0.1....
24.--duration of referential carrier (illustration 1) (µs)
25. 2.25 ± 0.23 (10±1 sinusoid)
26. Amplitude of referential carrier peak to peak (illustration 1)
27. 3/7 difference between suppression level and whiteness level ± 10%
28. Phase position of referential carrier
29. 135° in relation to the axis E'_U with the following sign (illustrations 3 and 4):
30. Half picture--do = to
31. Line
Even
Odd
32. Suppression of referential carrier: 9 lines of internal of suppression of half pictures (see illustration 4)
33. Lines
34. Synchronization of change of phase of referential carrier: with the aid of the E'_V component of the referential carrier (point 14)

(Table continued on following page)

1) Redni broj	2) Karakteristika	3) Vrijednost
1	2	3
4) 1	Koordinate primarnih boja	5) Crvena $x = 0,64$ $y = 0,33$ Zelena $x = 0.29$ $y = 0,60$ Plava $x = 0,15$ $y = 0,06$
6) 2	Koordinate boja za jednake primarne signale $E'_R = E'_G = E'_B$	7) Bijela D_{65} $x = 0,313$ $y = 0,329$
8) 3	Pretpostavljeno gama katodne cijevi prijamnika za prethodnu korekciju primarnih signala	2,8
9) 4	Signal sjajnosti	$E'_Y = 0,299\ E'_R + 0,587\ E'_G + 0,114\ E'_B$ 10) E'_R E_G i E'_B jesu gama korigirani signali
11) 5	Signali boje	$E'_U = 0,493\ (E'_B - E'_Y)$ $E'_V = 0\ 877\ (E'_R - E'_Y)$
12) 6	Slabljenje signala boje	dB MHz E'_U, E'_V $\begin{cases} < 3 \text{ na } 1,3 \\ > 20 \text{ na } 4 \end{cases}$
7	13) Jednadžba složenog video-signala boje	$E'_M = E'_Y + E'_U \sin 2\pi f_{sc} t \pm E_V \cos 2\pi f_{sc} t$ 14) gdje je: 15) E'_Y (vidi točku 4 ove tablice) 16) E'_U i E'_V (vidi točku 5 ove tablice) f_{sc} (vidi točku 9 ove tablice). 17) Predznak komponente E'_V isti je kao i pomoćnog nosioca — mijenja se od linije do linije (vidi točku 14 ove tablice i sliku br. 3).
8	18) Vrsta modulacije pomoćnog nosioca signala boje: Amplitudna modulacija, s potisnutim nosiocem, dva pomoćna nosioca u kvadraturi	
9	Frekvencija pomoćnog nosioca: — nominalna vrijednost i tolerancija (Hz) — odnos između frekvencije pomoćnog nosioca f_{sc} i linijske frekvencije f_H	19) 4 433 618,75±5,0 $f_{sc} = (1135/4 + 1/625) f_H$
10	20) Nominalni frekvencijski spektar moduliranog pomoćnog nosioca (KHz)	$f_{sc} \begin{cases} + 570 \\ -1300 \end{cases}$
11	21) Amplituda moduliranog pomoćnog nosioca	$G = \sqrt{E'^2_U + E'^2_V}$

1	2	3
22) 12	Sinhronizacija boje referentnim nosiocima:	
23)	— početak referentnog nosioca (slika br. 1) (μs)	5.6±0,1 poslije svakoga horizontalnog početnog vremena
24)	— trajanje referentnog nosioca (slika br. 1) (μs)	2.25±0,23 (10±1 sinusoida) 25)
26) 13	Amplituda referentnog nosioca od vrha do vrha (slika br. 1)	3/7 razlike između 27) razine potiskivanja i razine bijeloga ±10%
28) 14	Fazni stav referentnog nosioca	29) 135° u odnosu prema osovini E'_U sa slijedećim predznakom (slike br. 3 i 4):
		31) Linija — 30) Poluslika 1 2 3 4
		parna: — — + +
		neparna: + + — —
32) 15	Potiskivanje referentnog nosioca: 9 linija intervala potiskivanja poluslika (vidi sliku br. 4)	linije 33): 311 do 319; 623 do 6; 310 do 318; 622 do 5
34) 16	Sinhronizacija promjene faze referentnog nosioca: s pomoću E'_V komponente referentnog nosioca (točka 14).	

1. B--phase position of referential carrier in odd lines of first and second half-pictures and in even lines of third and fourth half-pictures.
2. B̄--phase position of referential carrier in even lines of first and second half-pictures and in odd lines of third and fourth half-pictures
3. Illustration 3

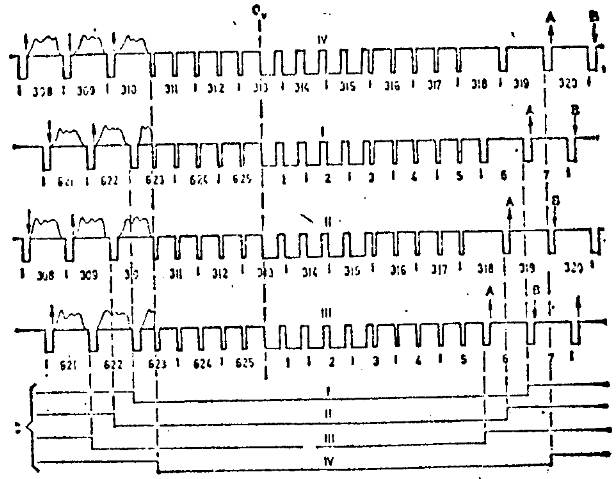


1) B — fazni stav referentnog nosioca u neparnim linijama prve i druge poluslike i u parnim linijama treće i četvrte poluslike

2) B̄ — fazni stav referentnog nosioca u parnim linijama prve i druge poluslike i u neparnim linijama treće i četvrte poluslike

3) Slika br. 3

1. Starting time of horizontal synchronization
2. First, second, third and fourth half-picture
3. Phase position of the referential carrier: nominal value + 135°
4. Phase position of referential carrier: nominal value - 135°
5. Interval of suppression of referential carrier
6. Illustration 4



O_V — početno vrijeme vertikalne sinhronizacije 1)

I, II, III, IV: — prva, druga, treća i četrvta poluslika 2)

A — fazni stav referentnog nosioca: nominalna vrijednost + 135° 3)

B — fazni stav referentnog nosioca: nominalna vrijednost — 135° 4)

C — interval potiskivanja referentnog nosioca 5)

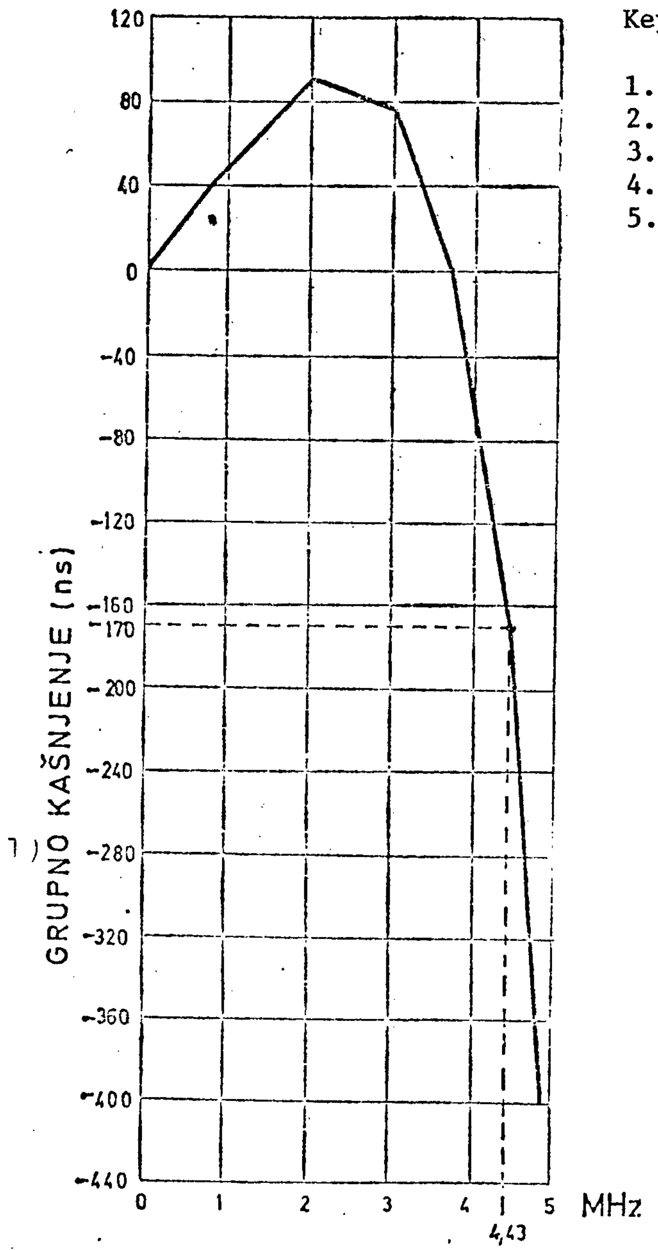
6) Slika br. 4

Article 24

The radio frequency characteristics of systems B and G are:

Number	Characteristic	Value
1.	Nominal width of the radio frequency Frequency channel	B:7 G:8
2.	Separation between the frequencies of the picture carrier and tone carrier	5.5
3.	Separation between frequency of picture carrier and closer channel edge (MHz)	-1.25
4.	Nominal width of main sideband (MHz)	5
5.	Nominal width of partly suppressed sideband (MHz)	0.75
6.	Minimal weakening of suppressed sideband (dB)	20 for -12.5 MHz 20 for -3.00 MHz 20 for -4.43 MHz
7.	Type of video modulation and necessary width of filtering band; negative amplitude modulations with suppressed lower sideband and necessary width of filtering band of	6.25
8.	Level of synchronization impulse expressed in percentage of peak value of carrier (%)	100

9.	Level of darkening impulse expressed in percentages of peak value of the carrier (%)	75 + 2.5
10.	Difference between levels of black and darkening expressed in percentages of peak value of carrier (%)	0
11.	Peak value of whiteness expressed in percentages of peak value of the carrier (%)	10-12.5
12.	Type of tone modulation and necessary width of filtering band; frequency modulation with necessary width of filtering band	134 kHz
13.	Maximum deviation of tone sending frequency (kHz)	± 50
14.	Emphasis of high tone frequencies (μs)	50
15.	Relationship between expressed power of transmitters of picture and tone	10/1
16.	Curvature of previous correction of group delay of receiver	According to illustration 5



5) Slika br. 5

Key:

1. Group delay
2. Nominal values and tolerances
3. Frequency
4. Group delay
5. Illustration 5

IV. Minimal Values of the Reception Signal and Its Protection

Article 25

The minimal value of the average strength of the television field signal for individual frequency bands is given in table 1.

Key:

1. Table 1
2. Band
3. Field of strength

1) Tablica br. 1

2) Opseg	I	III	IV	V
1	2	3	4	5
3) Jakost polja (dB/μV/m)	+48	+55	+65	+70

The values in the table represent fields 10 meters above the earth's surface.

The protection of the signals in the above table covers 50 percent of the reception sites and a percentage of time ranging from 90 to 99 percent.

Article 26

The minimal protection of the useful television signal for 1 percent to 10 percent of the time is:

1) for separation between the interfering and useful signal frequencies of less than 1kHz : 45 dB;

2) for transmitters with normal or precise movement, according to table 2.

Key:

1. Table 2
2. Movement
3. Type of movement
4. Type of interference
5. Normal
6. Precise

1) Tablica br. 2

3) Vrsta pomicanja	4) Vrsta smetnje	2) Pomicanje (x 1/12 f_H)													
		0	1	2	3	4	5	6	7	8	9	10	11	12	
1	2	3													
5) Normalno	T	45	44	40	34	30	28	27	28	30	34	40	44	45	dB
	C	52	51	48	43	40	36	33	36	40	43	48	51	52	dB
	LP	60	60	57	54	50	45	42	45	50	54	57	60	60	dB
6) Precizno	T	30	34	30	26	22	22	24	22	22	26	30	34	30	dB
	C	36	38	34	30	27	27	30	27	27	30	34	38	36	dB
	LP	45	44	40	36	36	39	42	39	36	36	40	44	45	dB

Where

T = tropospheric interference, 1 to 10 percent of the time (reference 30 dB for 8/12 line frequency)

C = constant interference (reference 40 dB for 8/12 line frequency)

LP = threshold of preceived interference

Article 27

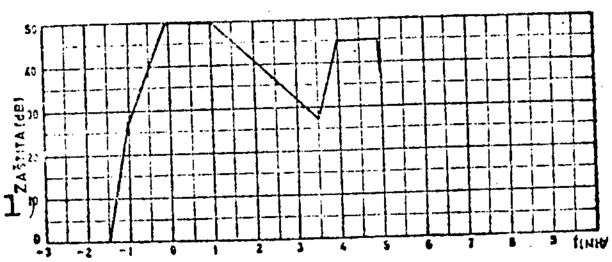
Minimal protection of the useful television signal for 1 to 10 percent of the time is:

1) for interfering signal from the upper adjoining channel--12 dB
2) for interfering signal from the lower adjoining channel--6 dB

Article 28

Minimal protection from an interfering unmodulated or frequency-modulated signal, for 1 to 10 percent of the time, which appears in the television channel, is given in illustration 6. If the interfering signal is amplitude-modulated, the protection must be increased by 4 dB.

1



2) Slika br. 6

Key:

1. Protection
2. Illustration 6

V. Technical Characteristics of the Television Transmitter

A. Common Regulations

Article 29

Only those television transmitters whose technical characteristics are specified by this regulation may be used in broadcasting.

Article 30

Transmitter strengths specified in this regulation are the strengths entering transmitting antennas.

Article 31

Television transmitters must be capable of modulation with the black picture and arbitrary tone modulation for a period of 24 hours.

Article 32

Television transmitters must be capable of resuming operation immediately after the error in the entering signal has stopped.

Article 33

The television transmitter must be manufactured in such a way as to have the technical characteristics specified by this regulation, under the following conditions:

1. The deviation from the net voltage of nominal value and while using stabilizers is between +5 percent and -10 percent (this does not pertain to values in the power of the transmitter).

2. The nominal value deviation from the network frequency (50 Hz) is ± 2 percent.

3. Elevation over sea level is up to 2,000 meters.

4. The area temperature may be from ± 5°C to +35°C.

5. Relative humidity in the work area may be up to 90 percent, with a maximum [temperature] of 26°C.

6. The high-frequency electrical field in the working area at any frequency may be up to 10V/m.

7. The power of the magnetic field in the work area caused by net frequency may be 4A/m.

The values listed in points 6 and 7 of this article must be established through measurements, and only if interferences should appear.

Article 34

The television transmittter must be manufactured in such a way that it can be adjusted for each channel of the frequency range for which the transmitter is to be used.

As an exception to paragraph one of the article, the transmitter may be intended to operate only in a portion of the frequency range.

Article 35

If the television transmitter is manufactured on the principle of interfrequency, it is necessary, for the picture interfrequency, to take the primary value of 38.9 MHz and for the tone interfrequency the value 33.4 MHz.

Article 36

For outside stimulation it is necessary to plan for an adapter with an entering impedance of 50 Ω, instead of the basic oscillator. The

stimulation of the transmitter must be made possible with a voltage whose highest value is 1V. It is also necessary on the television transmitter to specify the frequency of the basic oscillator for the channel.

Article 37

All degrees and cables in the high-frequency portion must be reduced to a nominal impedance of 50 Ω.

Article 38

The television transmitter must be electrically armored in such a manner than when a large number of transmitters are placed next to each other there will be no mutual interference.

Article 39

The warm-up time necessary to achieve the technical characteristics specified in this regulation must not exceed 30 minutes.

Article 40

The stability of the working frequency must be greater than 150 Hz in the course of 1 month.

Article 41

The precision of adjusting the carrier frequency must be greater than ±50 Hz. The equipment for adjusting the frequency precisely must have a scale which will allow for precision adjusting.

Article 42

An artificial antenna is necessary to measure the resistance in a television transmitter.

The nominal value of resistance of the artificial antenna is 50 Ω. In the frequency range of the transmitter, the coefficient of noncompatibility must be $s \leq 1.05$. The change of the coefficient of noncompatibility with the frequency in the working channel must not be greater than 0.02. The value resistance of the artificial antenna must reach the fifth harmonic frequency of the transmitter, but must not exceed 2,000 MHz.

The radiated power of the artificial antenna must be at least 50 dB below the reached power. The reference is the radiated power of the half-wave dipole in its main direction of radiation, which is fed a power 50 dB less than the power of the transmitter.

B. Technical Characteristics of the Picture Transmitter

Article 43

During the change between the white picture and the black picture the exit power must not change by more than 0.5 dB.

Article 44

The television picture transmitter must be manufactured in such way as to perform without damage when:

1) there is no color video signal entering the transmitter; 2) when some of the (color) components of the video signal are missing; and 3) when the color video signal is suffering from interference.

Article 45

The television picture transmitter must have an instrument for measuring noncompatibility, whose measuring capability during s = 1.05 is equivalent to or better than 0.02.

Article 46

The frequency tolerance of the television signal must be in accordance with article 17 of this regulation.

Article 47

The average radiation strength of secondary radiation on any secondary frequency, which is transferred to the antenna terminal, must be 60 dB below the average strength of the carrier and must not exceed the value of: 1) 1 mW for frequency ranges I and III; 2) 20 mW for frequency ranges IV and V.

For transmitters operating in the UHF frequency area (ranges IV/V) the combined frequencies of the picture and tone carriers in the upper and lower adjoining channels must be 40 dB below the picture carrier.

Parasitic oscillations must not be perceptible when the transmitter is activated.

Article 48

The equivalent radiation power, with the closed door, well-armored door and a well-armored artificial antenna must be within the following limits: 1) in the basic frequency 1 W for transmitters whose power is below 10kW, and 10 W for transmitters whose power is greater than 10 kW; 2) in the secondary frequency 1 mW for transmitters in the frequency ranges I and III, and 20 mW for transmitters in the frequency ranges IV and V.

Article 49

The television picture transmitter is modulated by a positive complex color video signal whose peak-to-peak voltage is 1 V, with level and tolerance relations according to articles 20 through 23.

Article 50

The video entrance impedance is 75 Ω, with a return weakening ≥ 30 dB for frequencies of up to 5 MHz.

Article 51

The exiting modulated radio frequency signal must correspond to characteristics in article 24 of this regulation.

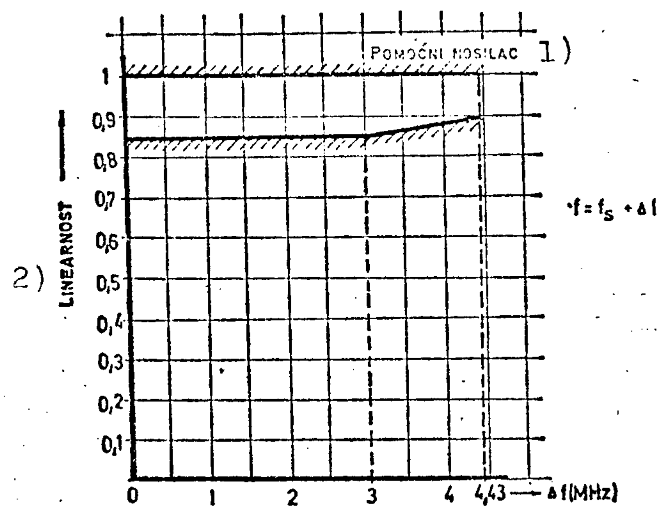
The values of the referential color signal may change only within the framework of allowed linear and nonlinear deformations in accordance with the rules of this regulation.

Article 52

Linearity must be within tolerances described in illustration 7.

Key:

1. Auxiliary carrier
2. Linearity
3. Illustration 7



3) Slika br. 7

For frequency 4.43 MHz, linearity (differential amplification) in the area of 10 to 87.5 percent of peak voltage (which corresponds to synchronization impulses), is considered.

For other frequencies from 1 MHz to 4.5 MHz the linearity in the area of 10 to 75 percent of peak voltage (which corresponds to synchronization impulses), is considered.

Provisions for correcting the linearity must be made in the television transmitter.

Article 53

The differential phase of the color signal with the transmitter modulaiton in the range of 10 to 87.5 percent pf peak voltage, during which the phase position of the auxiliary carrier is the reference, may be ±3° at the very most.

Article 54

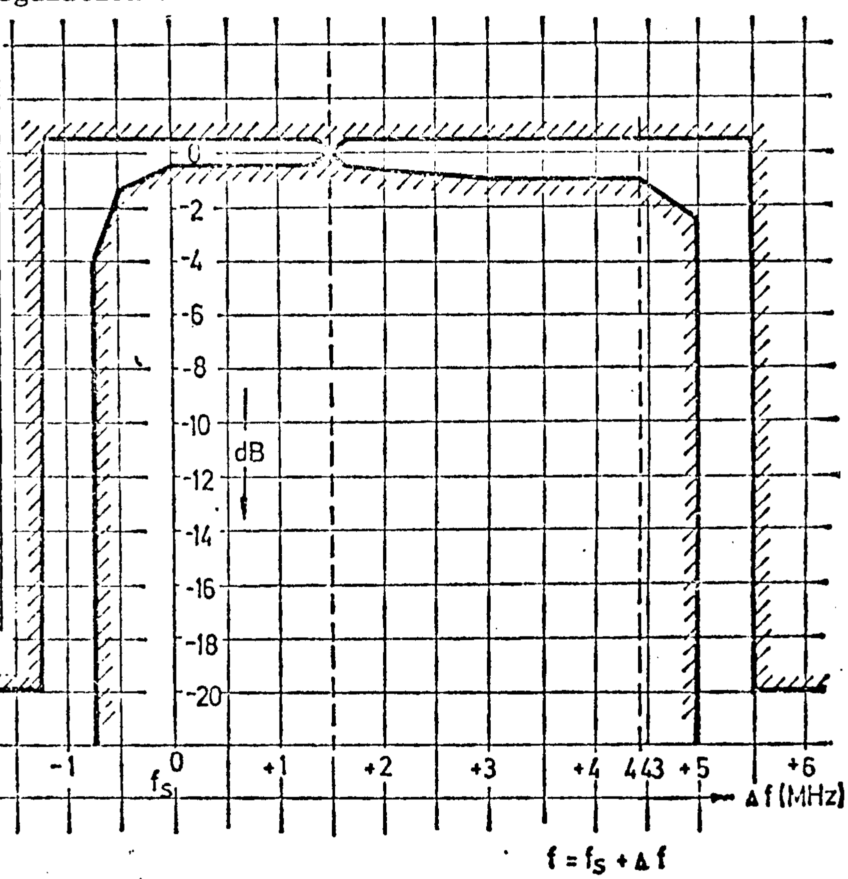
During modulation with sinusoidal signals with frequencies of up to 5 MHz and synchronization impulses, with a constant entering amplitude (modulation from black to white at 1.5 MHz) no sidebands of the higher order may appear outside the channel, whose amplitude is greater than -20 dB in relation to the unsuppressed side amplitude of 1.5 MHz.

The amplitude value of the carrier frequency during modulation with frequencies of up to 5 MHz must not change more than 0.5 dB.

Article 55

The amplitude of the side components must stay within the tolerances given in article 24 of this regulation and in illustration 8.

Δf(MHz)	1) GORNJA | 2) DONJA GRANIČNA VRIJEDNOST 3) (dB)	
-4,43	-30	—
≤ -1,25	-20	—
-1,25 do -0,75	+0,5	—
-0,75	+0,5	-4
-0,5	+0,5	-1,5
0	+0,5	-0,5
+1,5	REFERENTNA VRIJEDNOST 4)	
+3 do +4,43	+0,5	-1
+5	+0,5	-2,5
+5 do +5,5	+0,5	—
≥ +5,5	-20	—



5) Slika br. 8

1.Upper; 2. Lower; 3. Limit value; 4. Referential value; 5. Illustration 8

Amplitude tolerances above -1.35 MHz apply to any degree of modulation between the black level and the white level.

Amplitude tolerances below -1.35 MHz apply to complete modulation (10/75 percent).

Article 56

The total video-amplitude frequency characteristic, with random levels, must be found within the tolerance according to figure 9.

Article 57

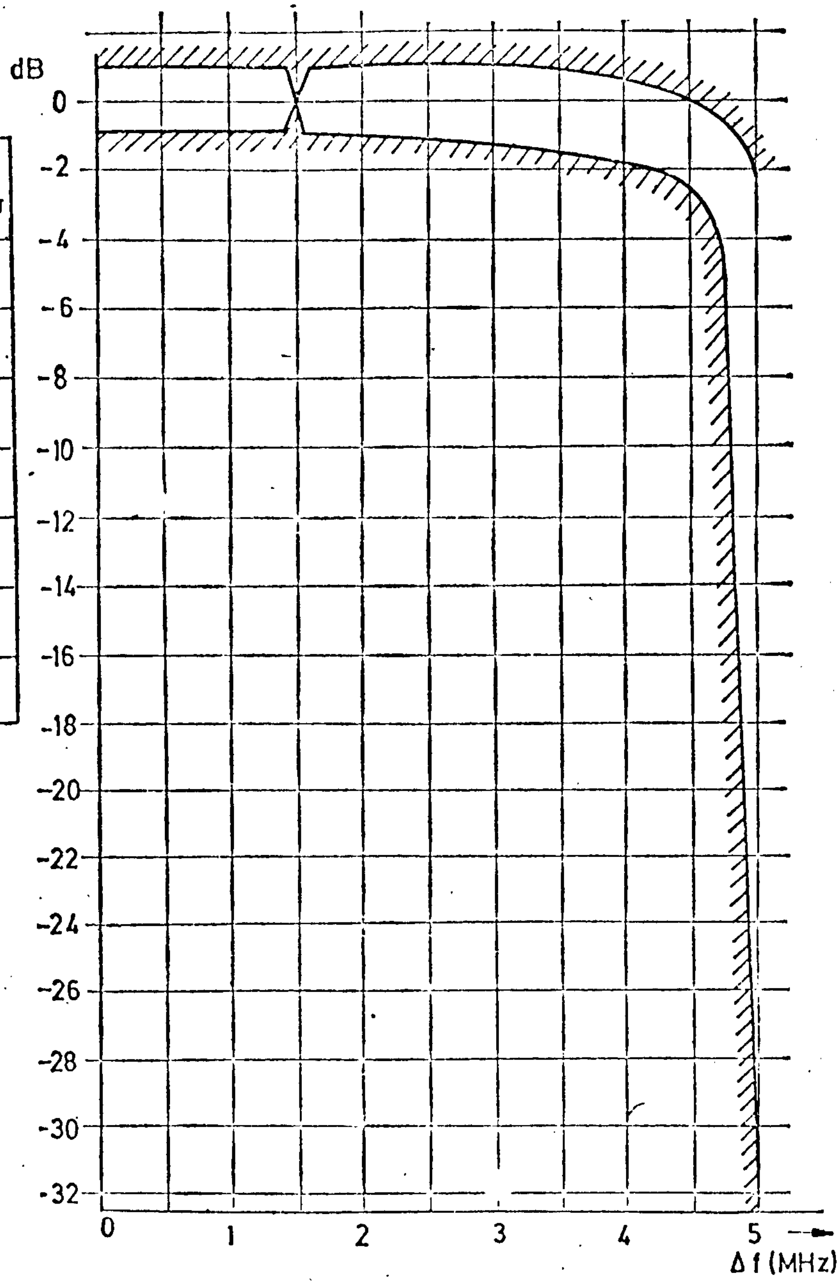
The response of the television transmitter to the right-angle impulse picture, whose repetition frequency is between 15 kHz and 250 kHz during the increase time 100 ns must, during the amplitude change of the high frequency from 55 to 75 percent and vice versa, remain within the tolerances given in illustration 10.

Article 58

The television picture transmitter must have an adjustable group-delay correction, which allow for correction of the transmitter group delay and the receiver group delay, on the basis of the precorrection curve of the receiver group delay in article 24, point 16 of this regulation.

Δf (MHz)	GORNJA 1) GRANIČNA 3)	DONJA 2) VRIJEDNOST (dB)
0 do 0,15	+ 1	- 1
1,5	REFERENTNA VRIJEDNOST 4)	
3	+1	- 1,5
4	+0,5	- 2
4,5	0	-2,5
4,75	- 1	- 6
5,0	- 2,5	--32,5

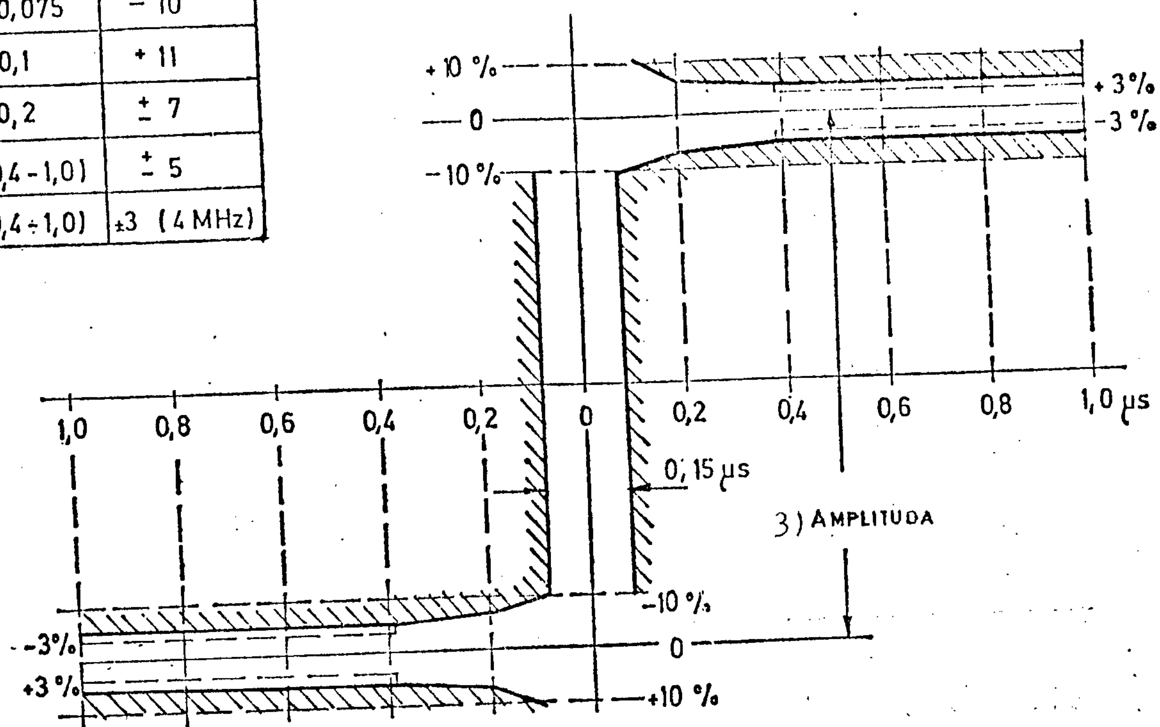
$f = f_s + \Delta f$



5) Slika br. 9

Key:
1. Upper
2. Lower
3. Limit value
4. Referential
5. Illustration 9

1) VRIJEME (μs)	2) GRANICE (%)
± 0,075	− 10
± 0,1	+ 11
± 0,2	± 7
±(0,4 - 1,0)	± 5
±(0,4 ÷ 1,0)	±3 (4 MHz)



4) Slika br. 10

Key:

1. Time
2. Limits
3. Amplitude
4. Illustration 10

Article 59

The angle of the right angle impulse, whose repetition frequency is 50 Hz to 15 kHz during the amplitude change of the high-frequency signal in the area of 10 to 75 percent of peak voltage, must stay within the limits of ± 2 percent in relation to the referential jump from black to white (10 to 75 percent).

Article 60

During test signals, to which correspond bright angles of arbitrary width and height on the black field, no level changes must be noticed in the black field during the exit from the television transmitter.

Article 61

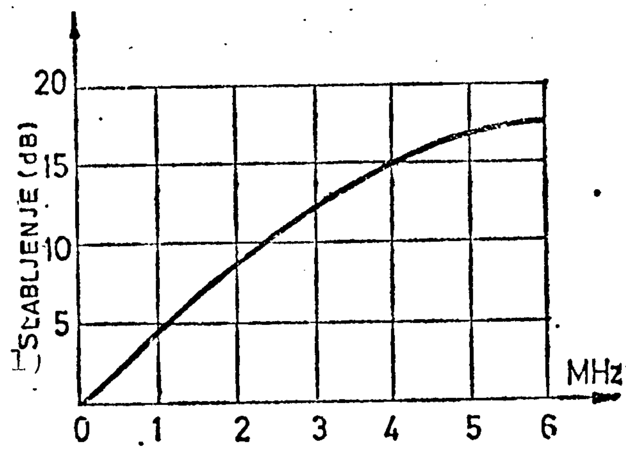
Protection from foreign voltages, for peak-to-peak values, must, in relation to the video signal value during full modulation from the black level to the white level, be at least 40 dB, at the white level as well as the black, which includes the tone transmitter with an arbitrary frequency modulation and deviation of 50 kHz.

Article 62

The signal-to-noise ratio, measured in accordance with the video signal value during full modulation from black level to white level, through the pondera-tion filter, whose characteristic is given in illustration 11, and with an instrument whose time integration constant is one second and which measures the effective values for the frequency area from 10 kHz to 5 MHz, must be greater than 56 dB, during which time the tone transmitter is modulated with an arbitrary frequency signal with a deviation of ± 50 kHz.

Key:

1. Attenuation
2. Illustration 11



2) Slika br. 11

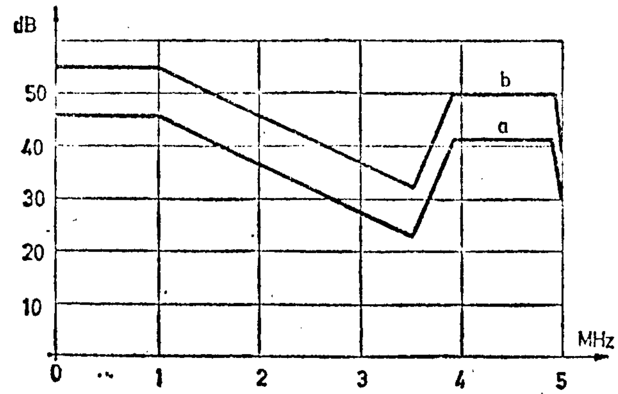
Article 63

Intermodulation products stemming from the picture carrier, tone carrier and picture modulation and which fall into the modulation frequency chan-nel of 5 MHz, with a picture transmitter modulation of 10 to 75 percent, taking as a referential amplitude the modulation frequency of 1.5 MHz, must not exceed the values indicated by the curve in illustration 12.

The combined oscillations falling into the channel must be suppressed in relationship to the value of the video signal during full modulation (10 to 75 percent) according to the curve in illustration 12, measured in peak values.

Key:

1. Illustration 12
2. Frequency
3. Combined oscillations (a)
4. Intermodulation products (b)



1) Slika br. 12

2) Frekvencija	3) Kombinirane oscilacije (a)	4) Intermodulacioni produkti (b)
MHz	dB	dB
0.....1	55	46
3,5	32	23
3,9.... 4,9	50	41
5,0	40	31

Article 64

Protection from the tone signal interference due to parasite angle modulation stemming from picture channel modulation with tone frequencies in the range of 40 Hz to 20 kHz with a picture carrier modulation of 10 to 75 percent, must be greater than 40 dB (measured with a psophometric filter), taking as a reference the deviation of ± 50 kHz.

Article 65

If the exit from the switch is closed with a measuring resistor of 50 Ω, the coefficient of noncompatibility in the frequency range of -0.75 MHz to +5 MHz must not be greater than s = 1.1. This applies to the arbitrary value of the final resistor on the tone-sending attachment.

Article 66

The television picture transmitter must provide for high-frequency measuring places for: 1) transmitter degrees which work in the final frequency and whose power is at least 200 W; 2) exit of the exiting degree of the transmitter; and 3) switch exit

The measuring places loaded with a 50 Ω resistor must give a voltage whose effective value is 1 V. The measuring places for the measuring demodulator with both sidebands loaded for 50 Ω must give a voltage whose effective value is 10 V.

The attachment of an arbitrary resistor to the measuring place must not cause any detrimental effects in the television transmitter. The voltage appearing in a cable not loaded may be, at most, five times greater than voltage with a resistance of 50 Ω. The amplitude frequency charactertistic of the measuring attachment must be such that a voltage can be obtained in the measuring resistor of 50 Ω whose frequency dependency is at the most 1 percent MHz (in the frequency range I--2 percent MHz).

A double directional coupler is necessary at the exit from the transmitter, with a characteristic impedance of 50 Ω, a directionality of 32 dB and a coupling which will insure a voltage whose effective value is 1 V at the loaded direct exist of 50 Ω.

Article 67

The video frequency measuring places in the television picture transmitter must be located at the following points: 1) at the video frequency entrance; and 2) at the modulator entrance.

All the measuring places must have a 1 V peak-to-peak positive value of the exit voltage in a 75 Ω resistor.

The amplitude frequency characteristic of the measuring places must not exceed the value of ± 0.5 dB.

The transmitting characteristics of the measuring places must correspond to article 52 and 53 of this regulation. If this is not the case, data on linearity and differential phases must be included with the transmitter.

All the measuring places specified in this article must have an attachment of the UHF or BNC type, or transfers to these types of attachments.

Article 68

The television picture transmitter must have an instrument to indicate peak power. The influence of the picture content on the readings of this instrument may be a maximum of 1 percent.

C. Technical Characteristics of Television Tone Transmitter

Article 70

In addition to the instruments necessary for adjustments, the television tone transmitter whose exit power is equal to or greater than 1 kW must

have indicators for: 1) exit power; 2) reflected power; and 3) frequency deviation.

Article 71

The television tone transmitter must be manufactured in such way as to give the nominal exit power with an impedance of 50 Ω, with a noncompatibility degree $s = 1.3$.

The transmitter with a built-in protector must automatically switch off if the degree of noncompatibility is greater than 1.5.

Article 72

At the exit level of the transmitter there must be a radio frequency-measuring attachment with an exit voltage whose effective value is between 3 and 5 V.

The radio frequency-measuring attachment must have an N-type attachment or a connection to such an attachment.

Article 73

The power of secondary radiation on any harmonic or secondary frequency measured in the absence of modulation which is transferred to the antenna must be 60 dB below the average power of the working frequency and must not exceed the value of 1 mW for the VHF area or 20 mW for the UHF area.

Article 74

The frequency deviation of the carrier signal, achieved on the television tone transmitter modulator must not, at the entering level of the modulation signal, deviate by more than 5 percent during operation of the transmitter.

Article 75

The voltage of the entering tone signal frequency of 1,000 Hz and an amplitude of 1.55 V must give a nominal frequency deviation of ± 30 kHz.

Article 76

The entering impedance of the modulator with a symetrical attachment must be in the frequency area of the transmitted modulating signal equal to or greater than 2,000 Ω.

Article 77

An entering attenuator must be at the modulator entrance.

The entering attenuator of the modulator must be capable of roughly adjusting the voltage in article 77 of this regulation by degrees of 1 dB each, from -6 dB to + 6 dB.

The entering attenuator of the modulator must be so adjusted during normal operation that the deviation will not exceed the value of ±30 kHz with an entering level of ± 6 dBm.

Article 78

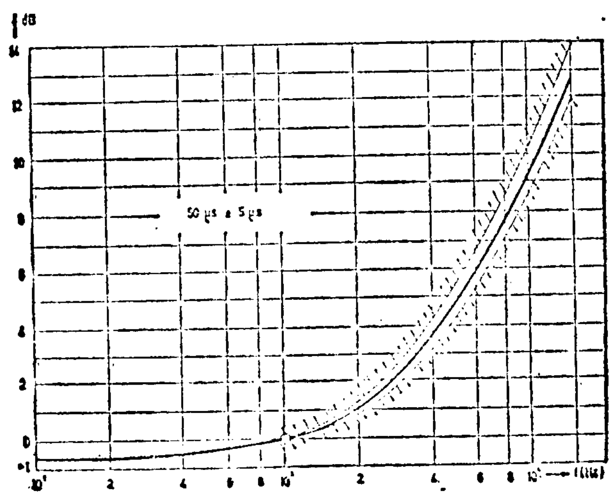
The television tone transmitter must have a net for emphasizing the high-tone frequencies, whose characteristics are given in illustration 12, as well as the capability for switching them off.

Article 79

The amplitude frequency characteristics with a disconnected net for emphasizing the high-tone frequencies must be in the entire frequency range from 40 Hz to 15 kHz within ± 1 dB, reference to 1 kHz, through deviations of ± 50 kHz.

Key:

1. Illustration 13



Article 80

The total coefficient of harmonic distortion of the tone signal in the modulated carrier signal when exiting with a disconnected net for emphasizing the high-tone frequencies, in the frequency range of 40 Hz to 15 kHz and with a frequency deviation of ± 50 kHz, must not be greater than 1 percent, while with a deviation of ± 75 kHz it must not be twice as great as the measured value during a deviation of ± 50 kHz.

Article 81

The maximum allowed intermodulation deviation of the modulating signal in the modulated carrier signal when exiting with a disconnected net for emphasizing high-tone frequencies, in the frequency range from 40 Hz to 15 kHz with a deviation of ± 50 kHz must not be greater than 0.6 percent

of the second degree deviation (d_2), or 1 percent greater than the third degree deviation (d_3), while with a deviation of $\pm$ 70 kHz they must not be more than twice as great as the measured values during a deviation of $\pm$50 kHz.

Article 82

The supression of the interfering signal of the television tone transmitter with a connected net for emphasizing high-tone frequencies, due to parasite frequency modulation in relation to the useful tone signal of the 1,000 Hz frequency, which give a ± 30 kHz deviation of the carrier signal frequency, must be greater than 50 dB (unpondered).

Article 83

The noise suppression, with a connected net for emphasizing the high-tone frequencies, due to the parasite amplitude of the carrier signal in relation to the useful tone signal with a 1,000 Hz frequency, which gives a frequency deviation of ± 50 kHz, must be greater than 60 dB (pondered).

Article 84

The suppression of the interfering signal with a connected net for emphasizing the high-tone frequencies, due to the parasite amplitude modulation of the carrier wave in relation to 100 percent amplitude modulation, must be greater than 46 dB.

Article 85

The suppression of the synchronized amplitude modulation, with a connected net for emphasizing the high-tone frequencies during modulation of the carrier signal by the useful tone signal with a frequency of 1,000 Hz and a frequency deviation of the carrier signal of ± 30 kHz must, in relation to 100 percent amplitude modulation, be greater than 34 dB.

VI. Technical Characteristics of the Converters

A. Common regulations

Article 86

For television radio diffusion, television converters having a power equal to or greater than 0.5 W, as well as miniature converters with a power of less than 0.5 W, may be utilized.

Article 87

The converters may be so manufactured as to give a nominal radiation power under a load of 50 Ω, with an allowable noncompatibility degree of $s = 1.2$. The converters must not be damaged by a noncompatibility degree of $s \geq 1.2$.

Article 88

The entering voltage area is 0.5 mV to 10 mV at 50 Ω.

Article 89

There must be no damage to the converter if there is a malfunction in the emitter or the converter which emits the feeding signal. When the normal state is established, the converter must be functional.

Article 90

The strength of secondary radiation on parasite frequencies must not be perceptible.

Article 91

The noise factor of the converter, with an entering signal of 2 mV, must be:

1) 9 dB--when the entering portion is in the frequency ranges I and III;

2) 10.7 dB--when the entering portion is in the frequency ranges IV and V.

Article 92

The converters must be manufactured in such manner as to satisfy the technical characteristics prescribed by this regulation under the following working conditions:

1. The frequency net deviation should be ± 2 percent of the nominal value (50 Hz).

2. The environment temperature should be from +5° to +45°C.

3. The environment temperature for the "specially manufactured" converters should be from =35°C to +45°C.

4. The altitude above sea level should be to 2,500 meters.

5. The relative humidity in the working area should be to 90 percent.

Article 93

Radio interference on the feeding leads must be within the bounds specified by the Yugoslav standard JUS.N NO.900 interference level K).

Article 94

The smallest distance between the receiving and transmitting channels is one channel. It is possible to receive on one channel of a frequency range and to transmit on a channel of another frequency range.

Article 95

The converters must have the capability to exclude the automatic regulators for amplification and have the capability to perform this function manually.

B. Technical Characteristics of the Television Converters

Article 96

Frequency changes must be accomplished on the interfrequency principle. For picture interfrequency the standard value is 38.9 MHz.

In the event of an unfavorable combination of channels, 45.9 MHz may be utilized for the interfrequency of the picture and value.

Article 97

When the entering signal disappears, the exiting power must be at least 20 dB lower than the nominal power.

If the entering signal is absent for $\leq$ 8 minutes, the equipment must not shut off.

The criterion for the automatic shutting off of the television converter must make possible an adjustment in the entering signal bounds of 0.5 mV-5mV.

Article 98

The technical charactertistics must be fulfilled when there is a suppression of $\geq$ 50 dB between the exit and entrance of the converter.

The effective value of the return voltage in any phase at the entrance must not exceed 0.5 V. It is measured with an entering voltage whose effective value is 2 mV.

Article 99

Television converters of up to 10 W, which are to be mounted outside, must be in a housing that will protect them from rain, snow, insects and condensation.

On television converters which are mounted outside, the receiver and the interfrequency amplifier may be separated from the exiting degree.

Article 100

The television converter must have an asymetrical impedance exit of 50 Ω, with a coaxial attachment 4.1/9.5 7/16 or 13/30.

Article 101

The television converter must have included with it a stabilizer of net voltage.

The net voltage stabilizer power must be so adjusted that the coefficient of harmonic distortion is less than 10 percent.

The speed of regulation for voltage changes from +10 percent to -30 percent must be greater than 10 percent of the nominal net voltage in a second.

The exit power (applies to converters with an exit power to 100W) for voltage changes from +10 percent to -30 percent, when the net voltage stabilizer is connected, must not change by more than ±0.5 dB in regard to nominal exit power.

For converters with an exit power of over 100 W, during a voltage change of +10 to -30, the technical characteristics may not change (except for exit power).

Article 102

The noise produced by the television converter at the height of 1 meter and at a distance of 1 meter from the front of the equipment may not exceed the value of 70 dB/B/.

Article 103

For television converters for the frequency ranges IV and V, provision must be made for a connection for outside oscillators.

The voltage level of stimulating signals must be $\leq$ 1 V, while the frequency of this voltage must be less than 150 MHz.

Article 104

The frequency stability of the oscillator 6 months after it has been activated should be ± 350 Hz for the 6-month period.

Article 105

The frequency tolerance of television converters which are to work without frequency movement is:

1) 100 x 10^{-6} or 100 Hz/MHz--for frequencies under 100 MHz and average power of 50 W or less;

2) 100 x 10^{-6} or 100 Hz/MHz--for frequencies above 100 MHz and average power of 100 W or less;

3) 1,000 Hz--for frequencies under 100 MHz and average power of more than 50 MHz;

4) 1,000 Hz--for frequencies above 100 MHz and average power of more than 100 MHz.

The frequency tolerance of television converters that work with normal movement must be in accordance with the values in article 17 of this regulation.

Article 106

A continuous frequency correction must be made possible. The equipment for frequency correction must be easily accessible and the correction must be visible on the scale. The frequency correction area must be at least ±5 x 10^{-6}f osc.

Article 107

A filter must be installed before the first active element, with the characteristics given in table number 3.

Article 108

The entering interfering signal with the interfrequency voltage of ≤ 1 V and a symetrical voltage of ≥ 0.1 V must not produce a greater signal when exiting than the signal obtained with an entering signal of 0.5 mV.

Key:

1. Table 3
2. Frequency reception
3. Suppression in ranges I and III
4. Suppression in ranges IV and V

1) TABLICA br. 3

f_0 — primanja 2) frekvencija	3) Potiskivanje u opsegu I i III	4) Potiskivanje u opsegu IV/V
f_0 + 14 MHz f_0 — 9 MHz	≥ 16 dB	
f_0 + 16 MHz f_0 — 11 MHz		≥ 20 dB
f_0 + 28 MHz f_0 — 23 MHz	≥ 36 dB	
f_0 + 32 MHz f_0 — 27 MHz		≥ 42 dB

Article 109

Changes in exit power caused by changes in the entering voltage from 2 mV for ± 12 dB must remain within a range of ± 1 dB.

The time delay of automatic regulation of amplification for a voltage jump of ± dB at the entrance must be less than one second.

The automatic regulation of amplification of television converters is accomplished in relation to the synchronization impulse of the television signal and must be independent of the picture content.

Article 110

During transition from the black picture to the white picture, peak power must not change by more than 0.5 dB.

Article 111

The average power of secondary radiation of television converters on any harmonic frequency, except for mixing frequencies, must be within the following bounds:

1. For frequency ranges I and III, according to table 4 (distances expressed in dB pertain to maximum power values):

Key:

1. Table 4
2. Exiting
3. Secondary radiation

4) TABLICA br. 4

$P_{izlazna}$ 2)	> 500 mW ≤ 10 W	> 10 W ≤ 1 kW	> 1 kW
$P_{spor. zrač.}$ 3)	≤ 25 μW	≥ 60 dB	≤ 1 mW

2. For frequency ranges IV/V--40 dB without exceeding the value of 1 mW.

The entering levels are given in illustration 14.

Article 112

The average power of secondary radiation of the mixing frequencies must be 60 dB less than the maximum power of the television converter and must not exceed the value of 1 μW.

The limit values from paragraph one of this article do not apply to the mixing frequencies in the adjoining upper and lower channels. The limit values in article 111 of this regulation apply to those frequencies.

The entering levels are given in illustration 14.

Article 113

The power of the field with an attached reception antenna for the television converter, which is loaded with a well-armored artificial antenna in relation to the power of the television converter during normal activity, must be decreased by: 1) 40 dB on the basic frequency; 2) 50 dB on secondary frequencies.

Article 114

The interference voltage at the antenna entrance which has been loaded with a nominal resistance of 50 Ωmust not be greater than the following because of oscillator frequency: 1) 20 μV for frequency ranges I and III; 2) 200 μV for frequency ranges IV/V.

Article 115

The interference signal, when caused by internal coupling in the converter with the attached entering signal, may be : 1) 20 μV when the entering portion is in frequency ranges I and III; 2) 100 μV when the entering portion is in frequency ranges IV/V.

Article 116

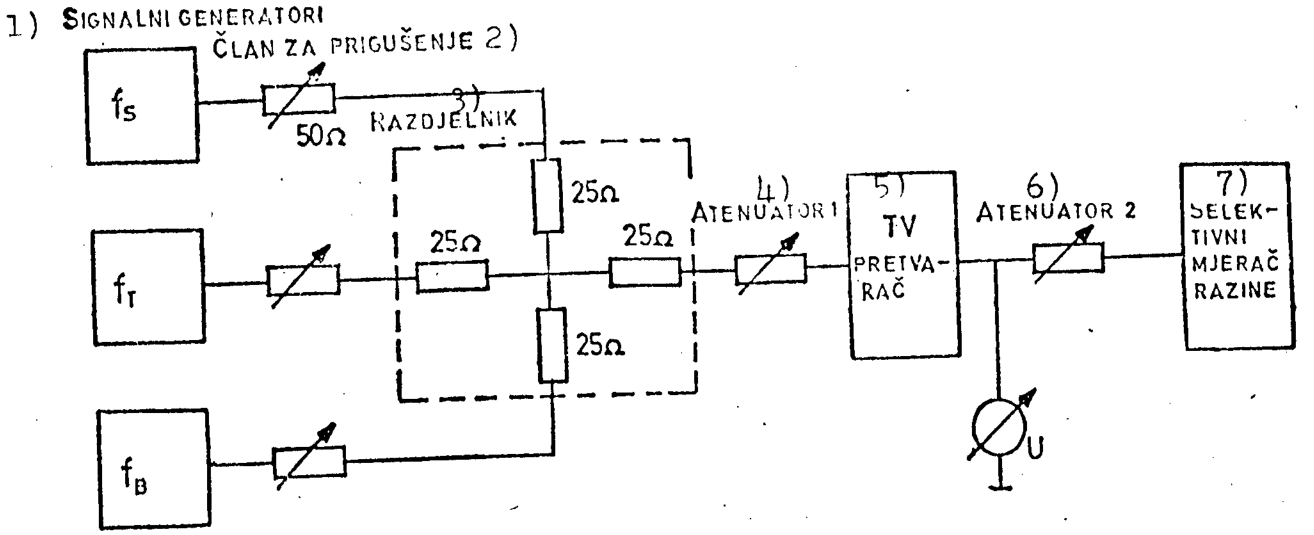
The suppression of the product of crossmodulation or interfrequency interference products in the frequency area f_s--0.75 MHz to +5.75 MHz must be 54 dB for the sideband components between f_s-0.75 MHz to f_s+5.00 MHz, during which f_s stands for the picture carrier frequency.

The limit values in paragraph 1 of this article apply to entering unmodulated signals whose levels are specified in illustration 14.

Article 117

A maximum change in the synchronization amplitude of 3 percent in relation to the synchronization value is allowed at the exit.

[Illustration 14 on next page]



8) Razine na ulazu TV pretvarača (dB)

9) Čl.	111 112 139 140	116 141	118 143	120
f_s	0	—8	0 ... —20	—3/—20
f_t	—10	—10	—10	—10
f_B	/	—16	—32	—32

13) Razina ništica dB odgovara nominalnoj snazi TV pretvarača

Ako zbog preopterećenja nije moguće primijeniti razinu od ništice dB, mjerenje obavljati sa — 3dB, i u tom slučaju mjerne rezultate treba povećati za + 3dB.

10) f_s — frekvencija nosioca slike
11) f_t — frekvencija nosioca tona
12) f_B — frekvencija bočne komponente

14) Slika br. 14

Key:

1. Signal generators 2. Supression article 3. Divider 4. Attenuator 1 5. TV converter 6. Attenuator 2 7. Selective level measuring device 8. Levels entering the TV converter (dB) 9. Article 10. f_s--picture carrier frequency 11. f_t--tone carrier frequency 12. f_b--sideband component frequency 13. The level of dB zero corresponds to the nominal power of the TV converter. If it is impossible to apply zero dB level because of overload, measuring is to be done with -3 dB, and in this case the results are to be increased by +3 dB. 14. Illustration 14.

Article 118

Linearity must not be worse than 0.95. The linearity of the television converter is considered for frequencies of up to 5 MHz.

The limit values from paragraph one of this argicle apply to unmodulated entering signals whose levels are stated in illustration 14.

Article 119

The differential phase of the color signal, during which the phase state of the auxiliary carrier is the reference, may be at the most 3°, and from 10 to 75 percent of the peak VF voltage with transmitter modulation.

Article 120

The total amplitude-frequency characteristics of the television converters for frequency ranges I and III must stay within the tolerances outlined in illustration 15, and for frequency range IV, according to illustration 16.

The tolerances in paragraph one of this article apply to unmodulated entering signals whose levels are stated in illustration 14.

Article 121

The differences in group delay must not, within the frequency range of f_s to +5 MHz, exceed the value of $\pm$ 50 ns, in relation to the value present in the picture carrier.

In the frequency range f_s - .75 MHz, an increase of $\pm$100 ns is allowed.

Article 112

The limits in articles 120 and 121 of this regulation also apply to all entering voltages in article 88 of this regulation.

Article 123

The deterioration in the slope of the right angle voltage of 50 Hz must not be greater than 1 percent in relation to the amplitude jump of 10 to 75 percent.

Article 124

The value of foreign peak-to-peak voltages must be, in relation to the video signal value under full modulation, from white level to black level, at least 40 dB.

Article 125

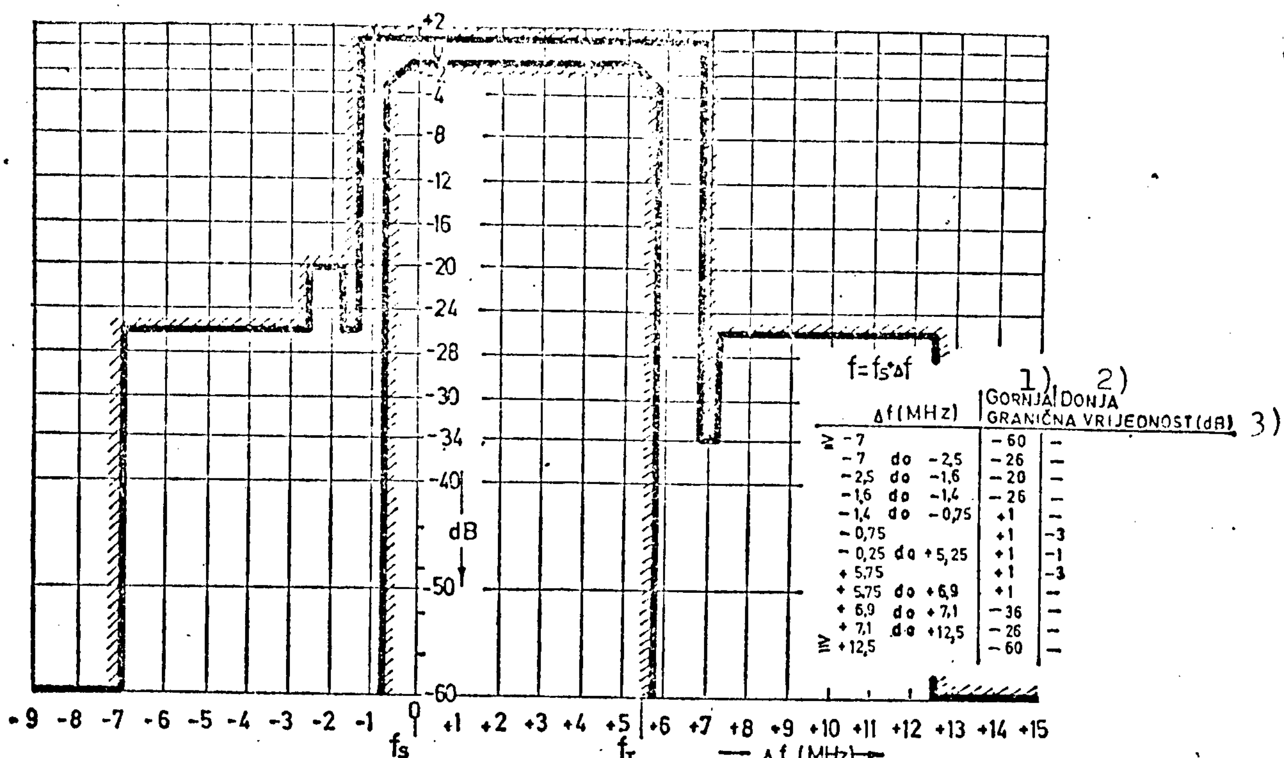
The suppression of the interference signals of the tone carrier due to the parasite frequency modulation must be $\geq$ 46 dB in relation to the useful tone signal of a 1,000 Hz frequency, which gives a 30 kHz frequency deviation of the carrier signal.

Article 126

The suppression of noise due to the parasite frequency modulation in relation to the useful tone signal of a 1,000 Hz frequency, which give a ±30 kHz frequency deviation of the carrier signal, must be $\geq$ than 58 dB.

Article 127

The possibility of controlling the following working values of the television converter must exist with the assitance of built instruments: 1) all important working voltages and currents, tubes and transistors; 2) oscillator voltages; 3) existing levels.



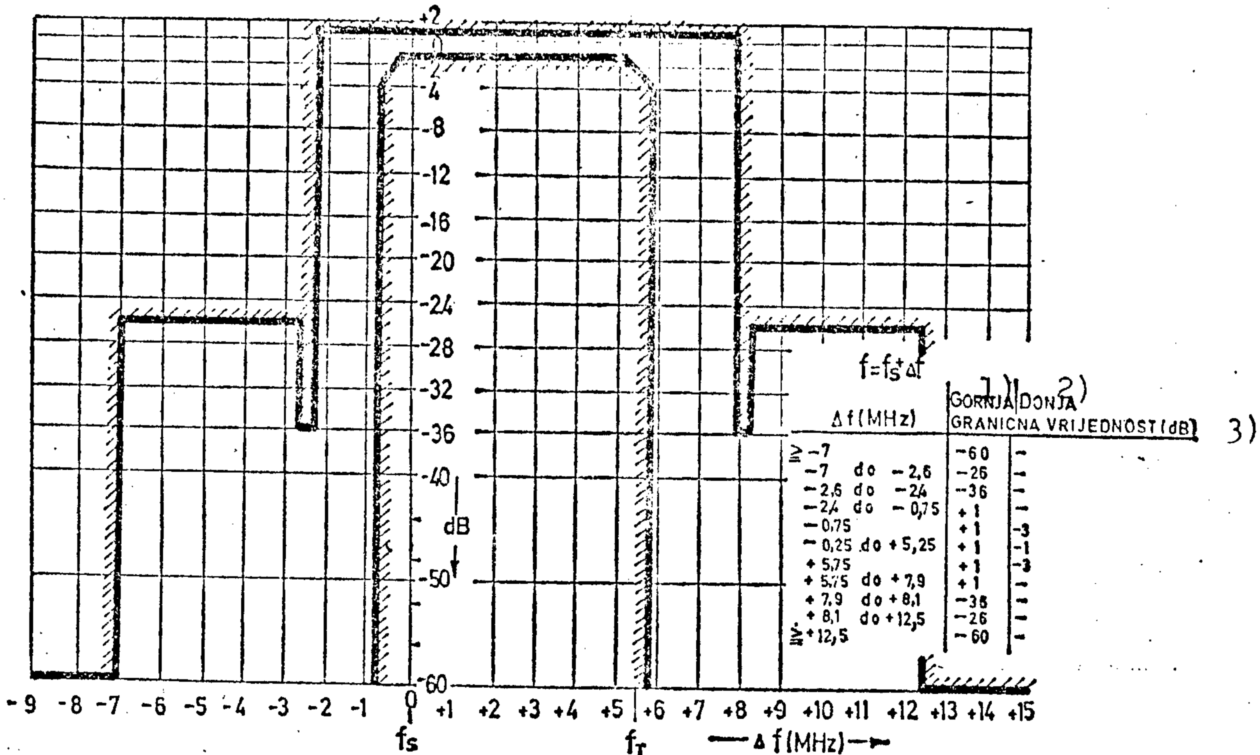
Δf (MHz)	1) Gornja	2) Donja
	Granična vrijednost (dB) 3)	
≥ -7	-60	–
-7 do -2,5	-26	–
-2,5 do -1,6	-20	–
-1,6 do -1,4	-26	–
-1,4 do -0,75	+1	–
-0,75	+1	-3
-0,25 do +5,25	+1	-1
+5,75	+1	-3
+5,75 do +6,9	+1	–
+6,9 do +7,1	-36	–
+7,1 do +12,5	-26	–
≥ +12,5	-60	–

4) Opseg frekvencije I i III

5) Slika br. 15

Key:

1. Upper
2. Lower
3. Limit value
4. Frequency ranges I and III
5. Illustration 15



4) Opseg frekvencija IV i V.

5) Slika br. 16

Key:

1. Upper
2. Lower
3. Limit value
4. Frequency ranges IV and V
5. Illustration 16

The working of the thermostat must be indicated when active.

Article 128

A measuring place for measuirng the level of the exiting signal must be provided on the television converter. A measuring attachment loaded with a resistor of 50 Ω must give the following voltages:

1. TV converter with an exit power of up to 10 W 0.1-0.2 V.
2. TV converter with an exit power of up to 10 W 0.1-1.5 V.

The amplitude frequency characteristics deviation may not, in the measuring attachment, exceed the value of 1 percent per MHz in a working channel.

The high-frequency measuring place has a coaxial attachment SNB, BNC or 4.1/95.

Article 129

The oscillator must be so constructed as to make possible the measuring of frequency and voltage in the oscillator. The measuring exit must have a voltage of $\geq$ 100 mV at 50 Ω.

C. Technical Characteristics of Miniature Television Converters

Article 130

The frequency change in miniature television converters may be realized according to the principle of interfrequency standard values prescribed in article 96 of this regulation, or with direct conversion.

Article 131

The technical characteristics of the miniature television converters must be fulfilled with a suppression of $\geq$ 50 dB exists between the exit and the entrance.

Article 132

The miniature television converters which are installed outside must be in a housing that will protect them from rain, snow, condensation and insects.

Article 133

The miniature television converter must have an asymetrical impedance entrance of 50 Ω, with a coaxial attachment of the type BNC or 4.1/9.5.

Article 134

For net voltage changes of +10 percent to -15 percent, a change in exit power of ±1 dB in relation to nominal power is allowed.

Article 135

The working frequency deviation of miniature television converters must be better than 100 Hz per 1 MHz.

Article 136

The area of entering voltage of the miniature television converter is 0.5 mV to 10 mV at 50 Ω.

Article 137

The change in peak power of the miniature television converter, caused by changes in the entering voltage of 2 mV for 6 ± dB, must remain within bound of ± 1 dB.

Article 138

During the changeover from black to white picture, the peak power must not change by more than 1 dB.

Article 139

The average strength of secondary radiation on any harmonic frequency must be suppressed by more than 40 dB or be less than 25 μW.

Entering levels are given in illustration 14.

Article 140

The power of secondary radiation in mixing frequencies must be suppressed by more than 54 dB.

Entering levels are given in illustration 14.

Article 141

The suppression of the products of cross-modulation or interfrequency interference products in the frequency range f_S-0.75 MHz to +5.75 MHz must be $\geq$ 50 dB for the sidebands between f_S-0.75 MHz to +5.75 MHz.

The limit values from paragraph one of this article apply to unmodulated entering signals whose levels are stated in illustration 14.

Article 142

A maximum change in the synchronization impulse of 5 percent in regard to the synchronization value is permitted in the exit.

Article 143

Linearity must not exceed the value of 0.9. Converter linearity is considered for frequencies of up to 5 MHz in the area of 10 to 75 percent of the peak value.

The limit values in paragraph one of this article apply to unmodulated entering signals whose values are stated in illustration 14.

Article 144

The amplitude frequency characteristics in the frequency range f_s-0.75 MHz to +5 MHz must be in the standard of $\pm$ 3 dB.

Article 145

Differences in group delay must not, in the frequency range f_s-0.75 MHz to +5 MHz exceed the value of ±100 ns.

Article 146

The limit values in articles 143, 144 and 145 of this regulation also apply to the entering levels from 0.5 mV to 10 mV and with an included automatic amplification regulator.

VII. Establishing Technical Characteristics of Television Transmitters and Converters

Article 147

The technical characteristics of the television transmitters and converters established by this regulation are established by measuring methods prescribed by the acts dealing with Yugoslav standards.

VIII. Transmitting and Concluding Rules

Article 148

The rules of this regulation will not be applied to those television transmitters and converters for which an installation permit or operating permit was issued before this regulation took effect.

An exception to the rule in paragraph one of this regulation is that if the television transmitters and converters for which an installation permit or operating permit was issued before this regulation took effect should cause interferences in radio traffic, their technical characteristics so far as radio interference is concerned must be brought into accordance with the rule of this regulation within 6 months of the date when it was established that the television transmitter or converter was causing interference.

Article 149

This regulation will take effect on the eighth day after the day of its publication in SLUZBENI LIST SFRJ.

No 1395/2
Belgrade, 7 December 1977

President of the Federal Committee for Transportation and Communications

[signed] Bozidar Dimitrijevic

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CSO: 5500

TELECOM INDUSTRY LACKS SKILLED MANPOWER

Johannesburg SUNDAY TIMES in English 18 Jun 78 p 8

[Article by Professor Johan Ribbens of the telecommunications department of the University of Pretoria in the "Business Times" section: "Labour Shortage Retards This Vibrant Industry"]

[Text]

THE telecommunication industry's involvement with everyday economic life, its strategic importance and its employment capacity, endow it with considerable power and responsibility.

This industry not only has a major service component in the Department of Posts and Telecommunications but, through its suppliers, has strong representation in the highly-skilled technological industry.

The state of telecommunications reflects the health of the economy as a whole and also the mental vigour of the manpower in this tertiary industry.

The telecommunications industry can be broken down into three sectors: professional telecommunications, represented by the Post Office and its suppliers; defence telecommunications and its suppliers, and the entertainment sector. The stability and backbone of the industry is supplied by the first two sectors.

Disregarding the initial TV volume, the industry represents a capital goods production of more than R500-million a year.

However, its progress is seriously hampered by the lack of adequately-trained manpower.

In the past, the Post Office has taken the lead with regard to local involvement and was responsible for setting up assembly plants and training facilities. With the decision to use fully-electronic exchange equipment in the future, the Post Office and its suppliers are confronted with a major quantum jump in required technological capability and availability of highly-skilled manpower.

Where the Post Office, in the past, has taken its cue from overseas, the situation has changed because of the international situation in which South Africa finds itself.

The defence telecommunications sector has adapted well to the situation in which it has found itself in the past 12 years. It has assimilated the most advanced technological processes and established facilities to enable it to manufacture the most advanced equipment. And it also designs and develops some of its own systems.

The interesting result of the changing environment is that the different sectors are moving together with

regards to the required technologies, components and skilled manpower. This process may be beneficial with regards to technology, but may have an adverse effect on the manpower situation, by placing an even bigger demand on the already depleted manpower pool.

Attempts to stabilise the manpower position, by restricting the freedom of movement of personnel is a counter-productive solution. It is hoped that the industry will use its power responsibly and imaginatively to further national interest in creating the necessary climate and facilities for training personnel.

While the Post Office has taken the lead and established excellent training facilities to train technicians for itself, the time has come for an equally responsible approach by the whole industry.

What is being done to meet the demand for engineering personnel, both in volume and level of education?

It is being viewed by industry at a much less serious level than the technician problem. Engineering training has, to a large extent, been left to the Department of National Education to solve. Financial involvement by the Post Office, defence and the supplying industries has been of a token nature and, as a result, has been less than effective.

The changing environment and the foreign threats will require capable engineering leadership — not only with the necessary in-depth technical training — but also with a creative and aggressive approach.

Where will this personnel come from?

From our universities, but the right type and quantity will only be produced if industry plays its part responsibly.

The lead time, from initiation of training, until this type of personnel becomes available, is a minimum of five years. It is thus important that planning and action should begin right now.

It is estimated that the country will need 180 new electronic engineers every year — a number which is not nearly met at this moment.

The University of Pretoria has recognised this manpower problem and established a department of electronics engineering in 1975 to train and supply manpower to the industry. At the moment, it is the only department catering exclusively for the telecommunications electronics industry.

It has become the fastest-growing engineering department in the country, with a total enrolment of 380, and a growth rate of 60 per cent a year.

The other universities have light current options in their electrical engineering departments which, although less specialised, are also able to help supply the required personnel to the industry.

Because the emphasis of manpower demand will soon switch from bachelor's degree level to master's degree, it is necessary that the university education be relevant to the industry's requirements and not only contribute to the paper rat-race.

It is hoped that a forum will be established under the leadership of the leading partners of this industry to rationalise and plan the manpower requirements for the next decade.

A lack of understanding of the above-mentioned situation will only lead to more and more restrictions on freedom of personnel, which will exclude imaginitive individuals from the manpower pool.

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ELECTRONIC PHONE SWITCHING SCHEDULED FOR 1980

Johannesburg SUNDAY TIMES in English 18 Jun 78 p 8

[From the "Business Times" Section: "EMD Exchanges Still Have a Long Life"]

[Text] BY 1985 there will be almost twice as many telephones in the world as there were three years ago, and the Republic will continue to lead Africa in the ratio of phones per capita, Colin Ferreira, executive director of Siemens said this week.

"Although the introduction of electronic telephone switching is scheduled for as soon as 1980, electro-mechanical (EMD) exchanges will be in operation for many years to come," he said.

"Siemens has supplied 123 EMD public exchanges with a total of 347 000 subscriber lines and 178 000 trunk lines. Orders received so far provide for a further 169 000 subscriber line and 109 000 trunk line units."

Mr Ferreira said that in addition to developments in micro-electronics, other factors had contributed to the development of electronic switching.

"The increased demands made on switching engineering have led to a new generation of computer-controlled switching systems. The new operating requirements include many which demand the use of electronic devices in the systems.

"Additionally, the flexibility of stored programme control (SPC) is desirable in order to facilitate easy adaption to changing requirements. This alone provides sufficient justification for transition to computer-controlled switching systems, while the increased use of electronic and miniaturised components will simplify production and maintenance as well as significantly reducing space requirements."

New technological developments had similarly taken place in the fields of telegraph and data communications. The Johannesburg public telex exchange was to have been semi-electronic, but would now utilise the fully electronic EDS system. Initially, it would provide 5 100 telex ports with provision for expansion to a total of 16 000.

The electro-mechanical teleprinter, the T100, was being replaced in the Post Office by the T1000, and the local production change-over would take place next year.

"Forecasts for the ESK range of PABX systems are promising," said Mr Ferreira. "Approval has been received from the Post Office for the ESK-L version, which means an expansion of the 60 exchange line unit from 400 to 600 extensions. The past year was the most successful experienced in this area of activity.

"Another successful innovation has been the Metro fee recording system, which will can be attached to a switchboard of any make. It records all relevant data relating to each call and is an excellent means of controlling telephone usage."

Siemens has also introduced sales, training, maintenance and research for application of microprocessors to the local market. Already completed projects are those of abbreviated automatic dialling and maximum demand metering.

"At present, intensive training and development is well under way to provide know-how and expertise for future telecommunication applications," Mr Ferreira said.

"Siemens also offers courses ranging from the basic micro computer concept to applications of high level languages."

CSO: 5500

WANG LABORATORIES SELLS SOUTH AFRICAN SUBSIDIARY

Johannesburg SUNDAY TIMES in English 18 Jun 78 p 26

[Article by Tony Koenderman in the "Business Times" section]

[Text] THE $200-million-a-year American mini-computer manufacturer, Wang Laboratories, has sold its South African subsidiary to local interests which include former Trust Bank chief Dr Jan Marais.

The R2,5-million deal was concluded as a way of averting sanctions pressures — seen as primarily aimed at US investment in SA, rather than at sales to this country.

"Wang's top management could foresee a situation where it would be forced to balance continued presence as a company here against important interests elsewhere in the world," said managing director Martin Hammerschmidt.

"So I offered to take over the company's capital investment here and to form a distribution and servicing company to market its products."

A new company, General Business Systems, has been formed for this purpose, headed by Mr Hammerschmidt. Other directors are Paul Bladergroen and Dr Marais.

Wang vice-president responsible for Africa, Johannes Spanjaard, says there is no question of disengagement from the SA. With subsidiaries in 18 countries and agents in another 45, Wang gets 45 per cent of its turnover outside the US.

In a fast-growing company (revenue rose 40 per cent last year), the SA subsidiary (up 48 per cent) shines. Local turnover is about R3-million a year.

CSO: 5500

ARMY WILL HAVE AUTOMATIC COMMUNICATIONS NETWORK BY 1982

Paris ELECTRONIQUE ACTUALITES in French 26 May 78 pp 1, 9

[Article by D. Levy]

[Text] Epinal. With a view to meeting the future needs of the Army for telephony, telegraphy and data transmission, the RITA (Integrated Automatic Transmission Network) will equip the first three Army Corps by 1982 and the other two by 1985. At that time, the RITA will be capable of placing in operation on the order of 700 Hertzian stations, 100 real-time, electronic autocommutators, 200 concentrators, 100 radio junction centers and some 1,200 radio integration sets. All of the production contracts for the major components have been let and the initial hand-assembled orders will be filled by the end of the year, followed by mass-produced orders next year. The total RITA program will require the expenditure of 3 billion francs and is said to involve most of the French telephone industry.

After the Prototypes

After a three-year experimentation period, which will end next July, in the Epinal 18th Communication Regiment during which the operational value of the system will have been demonstrated (the 45 different experimental prototypes have accumulated 4,000 to 6,000 hours of operation), the RITA will enter the production phase with hand-assembled equipment which will equip an experimental unit (eight nodal centers) in 1980, then with mass-produced equipment which will equip the three Army Corps between 1982 and 1985. The mass-produced equipment will be distinguished from the prototypes by a normal evolution of the state of the art and by improvements in certain operations.

Out Front

General Craveille, deputy director of Communications, has emphasized that "France is out front with the RITA," being the first to place a numeric telecommunications system in operation in the Army.

As a matter of fact, it is known that the projects of the U.S. and Great Britain have not yet been successfully concluded and that Germany, which had participated with France and Belgium in the initial design stage of the RITA until 1969, is developing its own system, "Autoko," which is less sophisticated than the RITA and is dependent upon a fixed infrastructure. Belgium, on the other hand, has decided to pursue the development of the RITA in common with France.

A Shielded and Numeric Network

The RITA, which is characterized by its numeric technique, is a communications network based upon nodal centers located on high points of the terrain and interconnected by Hertzian clusters. Each nodal center is equipped with an electronic autocommutator, on the one hand, which assures the automatic routing of communications, and on the other hand, radio junction equipment which permits the establishment via radio integration of nine simultaneous communications.

The nodal centers are spaced 20 to 40 kilometers from one another, depending upon the terrain. Their number, designed to cover the area of operation of an Army Corps, is a function of the dimensions of the area and also the number of Command Posts to be linked. In this regard, it is estimated that an average of 30 nodal centers will be required at the Army Corps level, permitting the servicing of 2,000 to 3,000 users.

The electronic autocommutator commanded by the "15M/125" computer permits the simultaneous handling of traffic from a maximum of 12 functions of 24 MIC. The concentrator assures the linking of users (50) to the central and handles the conversion of voice frequency signals into numeric signals.

The Hertzian clusters which assure the transmission of communications between nodal centers appear in the form of a modular family permitting coverage of three frequency ranges (1,350-2,700 MHz, 400-960 MHz and 225-400 MHz). Their transmission capacity is 1,152 Mbits/s [millibits per second].

The radio integration system permits the linking of mobile users with the same facilities as those offered to other users. With his transceiver, the mobile user can "enter" the network at any point by means of radio linkage converters installed in the nodal centers. The converter permits nine users within radioelectric range to simultaneously establish communications with any other users of the network.

Great Operational Possibilities

Among the terminal equipment used by the RITA, let us mention the high-speed telegraphy terminal, TETRA, with 600 bauds; the high-speed facsimile [system], FSR, which is capable of transmitting a document in the A4 format in 27 seconds; the mixed manual central, which permits the linking to the RITA of telephone users with central or local power sources, of the PTT

[Postal, Telephone and Telegraph Service], of VHF and FM radio sets, airliners in flight, conference rostrums capable of placing seven users in communication, the automatic telephone interface for the linking of users to the tactical networks of the RITTER [Integrated Army Communications Network] or of NATO, and the automatic message reception and transmission center, designed to automatically handle messages from the Army Corps Command Post and to broadcast these messages.

The RITA offers remarkable operational possibilities, guaranteeing continuity of communications between correspondents by reducing traffic routing delays and offering great protection from enemy action (shielding, encoding...).

Most of the companies in the French telephone industry are participants in the RITA network, such as Thomson-CSF [General Radio Company] and the SAT [expansion unknown] for the Hertzian clusters; the LCT [Central Telecommunications Laboratory] and the LMT [expansion unknown] for the electronic commutators; CIT-Alcatel [expansion unknown] for the radio interface; TRT, LTT and Sagem [expansions unknown] for the transmission equipment. CII (SEMS) [expansion unknown] computers and SINTR [expansion unknown] consoles are also being utilized.

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FRANCE

DIRECTIONS OF NAVAL TELECOMMUNICATIONS RESEARCH DISCUSSED

Paris DEFENSE NATIONAL in French May 78 pp 125-134

[Text] Modulation is the operation of impressing the message to be transmitted upon one or more of the parameters of the wave chosen as the carrier. The modulating signal in general has a small spectral extent on one which is very small in comparison with the carrier frequency. The bandwidth about the carrier frequency f_0 which can be used is limited by the coherence band of the propagation medium. This coherence band may be simply defined by the frequency difference $f_2 - f_1$, which can be tolerated so that the modification effected by the medium at each of the extreme frequencies, f_1 and f_2, are of the same order of magnitude. It can be further stated that it is the frequency difference for which the transfer function of the medium, G (f), is approximately constant. It is easily understood that, if the spectral extent of the modulated wave is smaller than the coherence band, all is well and each component frequency of the modulated wave is perturbed equivalently throughout the transmission channel. Therefore little restoration of the signal shape need be done at the point of reception. Thus propagation conditions, whether they be a matter of interactions with free electrons of the ionosphere or multiple propagation paths as a result of various reflections from obstacles or layers of the ionosphere, can be represented overall by a transfer function G (f), hence a coherence band of the medium. As for orders of magnitude: coherence bands are on the order of a few hertz (Hz) at 100 Hz, several hundred Hz for 20 kilohertz (kHz), and several kHz in the lower HF (high frequency) range, in short, on the order of several percent of the carrier frequency.

The chosen modulation must therefore be adapted to the coherence band. This amounts to saying that, considering the small coherence band up to the HF range, modulations must be used which provide small spectral extent, that is, limited to:

amplitude modulated analog transmission, or better still single side-band modulation which requires a spectral only half as large; and

digital transmissions with low phase modulation (PSK) rates, or if not, with frequency modulation (FSK), the choice between the two having to be made on the basis of the different considerations of transmission noise or the possible need to change frequency in order to increase secrecy and security of transmission, and so forth.

If the propagation medium is not excessively perturbed, and if the phase of the wave does not vary with excessive randomness, it is preferable to use binary phase modulation, 0 and π, or even quaternary, 0, $\pi/2$, π, and 3 $\pi/2$, if conditions are favorable. Such binary modulations require a half-band which is less than those required with frequency modulation. In the HF both these types of modulation exist. In the most difficult cases it is frequency modulation (FSK) which is adopted. For instance, in the very low frequency (VLF) range the phase of the received wave is greatly perturbed by the surface conditions of the sea and at present only binary FSK is being used. A more complex processing of the received signal would probably permit binary VLF-PSK transmission, but would it be worth the trouble?

Power

HF links over great distances require power on the order of several hundred watts, even going as high as a kilowatt or more. Transmitters must transmit the modulated wave without non-linear distortion, otherwise a transmitter supposed to transmit in a given band of frequencies would also transmit different frequencies outside of that band as a result of non-linearity in the power stages. The disadvantage is two fold: waste of energy on frequencies not necessary for the transmission, and disturbance to other links, especially saturation of a receiver working nearby. The drawbacks are partially avoided by using highly linear power stages and by improving transmitter-receiver isolation as has already been said. More particularly, as far as links of very great distance in the VLF range for submarine are concerned, the power required for the transmitter is very much larger, on the order of 1 megawatt.

Considering the antenna efficiency at these kilometer-wavelengths it is fed at about 10,000 volts and several hundred amperes, which corresponds to several megawatts input to the antenna. Efforts have devoted to making the antenna radiate as well as possible; it consists of several pylons 300 meters high connected to each other by a conducting sheet so as to form a sort of roof which has a capacitative effect corresponding, from the electrical standpoint, to extending the height of the pylons. Be that as it may, the height of these pylons remains small in comparison with the wavelength of 20 kilometers, at their bases, which are capable of carrying the very high currents without giving rise to losses by Joule effect, and hence of very low ohmic resistance. This bulk, this necessary power, and the cost of installing such a transmitting station are indeed specific characteristics of naval transmission.

Coding

The greater portions of transmissions are steel analogic or plain language. Certainly, the imperative necessity for message secrecy more and more implies the use of digital transmission channels which are more suited to coding or enciphering with very great security. It is partly thus as far as information transmission in HF channels is concerned with cadences of several hundred to several thousand bits. In the VLF range the small band width available (50 to 100 Hz) necessitates very slow modulation, on the order of 50 impulses per second. This means, in the very common case of 1 or 0 binary information coding, only 50 bits per second can be transmitted. This low data cadence is further reduced by the fact that it is desirable to assure a very small error rate in transmitting the message; there must then be introduced redundent bits and error detection bits and possibly errors in the message must be corrected. Overall the true cadence is on the order of 20 bits or less, but operational requirements in the VLF range as far as this point is concerned are not compelling.

We have mentioned the problem of enciphering, the purpose of which is to prevent an adversary's comprehension of the sense of the message. Another technique is to make it impossible for the enemy to receive the message.

Counter-Measures

This term means that it is sought to avoid the enemy's being able to "measure" our transmission, that is, "acquire" it. The principle to be applied is always the same: the information to be transmitted must be spaced in a spectral band of maximum width. This may be accomplished in two different ways in the case of a binary digital transmission:

either by tranmitting very short impulses, hence with very wide band; or

by transmitting long impulses but whose frequency varies during the impulse duration, that is, adopting the technique used in the case of impulse compression radar.

These methods have their inherent advantages and disadvantages and there are, here again, constraints of frequency or propagation, transmission lunearty, and so forth, which determine the options

Let us simply point out that the first method, called "short impulse transmission" has the advantage of making it difficult if not impossible for direction finders to get a fix on HF transmission. Nevertheless the enemy can realize that there was a transmission. The second method is more secret in the sense that it permits transmitting a bit of information with power as low as may be desired since only the receiver who knows the compression code can receive all the energy transmitted during the transmission duration and concentrate it at a given instant in order to make "the signal emerge from the noise;" this is the processing gain, obtained by impulse compression, that is well known to radar specialists. Certainly, other methods of information coding can be used (with their own advantages or difficulties in exploiting depending upon the frequency band utilized or the bit transmission cadence per second to be maintained) which more or less belong in one or the other of the two categories which we have just discussed.

Another method, called "frequency agility," consists of selecting, for each time interval, the transmission frequency. The cadence or speed of the agility is inversely proportional to the time interval during which a fixed frequency is used and transmission of the future will use agility cadences on the order hertz or kilohertz or even greater. This amounts to saying that the receiver which is to receive the "agile" transmission will know the code of frequency change as a function of time and will thus follow the transmission procedure of the transmitter with frequency changes every second, every millisecond, or even more frequently.

One can imagine the increasing complexity of the equipment which will afford these possibilities but this is becoming a necessity since the frequency range used is known by virtue of propagation considerations which we have cited and it is the coding, a priori introduction of information in the message, which will assure non-identification of that message by those not in a priori possession of such information.

Last, even though everything is well understood at the level of information theory, the serious technical and technological problems which arise have not been resolved for all that. For example, let us mention the need to have available very wide band antenna systems, synthesizers of high frequency agility and signal purity, power stages of great band width and highly linear, scanning receivers whose turning can be rapidly varied, and so forth. At this time such difficulties have been only partially resolved. Still more problems arise in conference operation of several transmitters and receivers. Should there be a master station controlling the transmission rhythm to which the other correspondents must be subordinated, which presents the problem of that station's vulverability, or should the network work asynchronously, synchronization being effected upon transmission from one to another? There are so many questions which show that all is not settled and that multiple solutions are sometimes adopted.

Information Comparison of the Voice Signal and HF

Studies and research aimed at reducing the digital flow of a digitalized speech signal to some 1,200 bits per second are particularly adapted to the Navy's transmission problems because the usable bands are of small width as a result, as we have already said, of the small width of the coherence bands of HF links. The 1,200-bit per second flow is well adapted both to this low capacity of HF channels and the difficult problem of coding and its compatibility.

Evolution of Transmission by Warships

Description of several typical installations has shown, in the case of large ships, the complexity of the installed transmission equipment. But, service is not being rendered in optimum fashion; as a matter of fact, the individual devices, particularly the BLU, are very expensive and are not being exploited at their maximum potential (for example, only a single modulation mode is used at a time, the racks for operation of the other modes being idle). What

is more, the reliability of the whole is not very good because if a synthesizer element or power supply breaks down the entire transmitter-receiver ensemble is out of service and the user who had been connected, by means of a manual switchboard, to that apparatus no longer has communication; thereupon several manipulations are necessary in order to provide another apparatus on the same frequency to that operator. For all these reasons it appeared to be of interest to design transmitting systems capable of replacing all those individual apparatuses; we shall briefly point out several systems with this objective in view now under study.

From the technological standpoint we are witnessing a very rapid evolution toward digitalization of apparatus, which not only makes possible reduction in weight and size but also in price since it is possible to use conventional logic circuits.

The new modulation processes and development of encoded telephony are also going to alter greatly the exploitation of transmission and ideas on frequency channels.

Last, undoubtedly within a few years the main part of information will be exchanged by means of satellites and such channels of communication will supplement the HF and UHF channels.

A--Principal Studies

Several systems are under study: an integrated communications system, a centralized maintenance system, a internal links system, and an adaptable links system.

Integrated communications system--The subject of the integrated communications system is the ensemble of radio transmission. It should make it possible to establish the optimum organization from the three-fold standpoint of performance, operational availability, and cost. The principal points to be studied precisely are:

antennas;

transmitters; and

organization: the individual apparatus being used for only a small fraction of the time, cannot a user be assigned a transmitter or receiver just for the time necessary for his conversation? This presents difficult problems which, if resolved, will enable the same service as at present to be obtained with a reduced number of transmitters and hence, at lower cost.

Internal links system--We have seen that the equipment for internal links is widely dispersed and that cabling represents one of the main cost elements of the whole. It appears of interest to study a total system wherein information (intercom, telephone, and radio remote control) would be sampled and put into digital form (using Delta Modulation) and multiplexed in time over the same cable arranged in a loop.

Centralized maintenance system--Study of the integrated communications system has led to contemplation of a maintenance system which, besides, is applicable to all electronic equipment, radars, sonars, and so forth. The objective of this system is to increase, at the lowest cost, the operational availability of the quipment, which is connected to continuous testing facilities and to provide, upon breakdown highly significant assistance which is reduced to simple and rapid operations without specialized personnel (preventive and corrective maintenance).

Adaptable links system--It is of interest to adapt tranmitted signals to the transmission channels; for example, for HF links over great distances, which utilize reflection by the ionosphere, the optimum frequency can be selected by use of ionosphere sounding equipment. Likewise, matters of coding, authentication, and error detection and correction should be adapted to the type of link.

The above discussion shows the importance of the studies in progress, which will completely revolutionize transmissions such as they have been previously described, but it must always be kept in mind that the new system will be acceptable only if it does not cost too much, that is, if it provides better service at the same cost or the same service at lower cost. But in this cost there must be considered such elements as decreased expense for maintenance, personnel, training of personnel, and so forth.

B--Digitalization of Equipment

More and more analog circuits are being replaced by digital circuits, which are more reliable and less costly over the long term because they use repetitive circuits which, with integrated circuits can be made in large production runs at low cost.

This transformation has begun with synthesizers and data transmission terminals. But more and more filters are becoming digital. Likewise, analog information is being sampled and transformed into binary signals which are easier to process with these digital circuits.

All this will facilitate the establishment of the above mentioned systems and equipment control by computer. This evolution can be summarized in the following statement: transmission of information will more and more have recourse to data processing.

C--New Modulation Processes

In the future it is probable that new modulation modes will be utilized. This is made possible by the stability of oscillators and the decreased size and cost of logic circuits. Most of the processes use a wider band to compensate for the low energy level of the signal and thus, with the same transmission power, they enable a higher signal to noise rates to be obtained.

Above all these processes are of interest in the case of binary signals; that is why digitalization of speech will be developed in the next few years.

In general, all the processes which will be employed will have recourse to correlation techniques and the theory of random variables, their development is now restrained by the costs resulting from the complexity and most of all by the requirements for compatibility, especially with foreign navies.

D--Satellite Links

To escape the restrictions to frequency bands imposed by propagation, ships, submarines on the surface, and ground stations can in addition communicate by relay from passing satellites or geostationary satellites. The problems of directing the antennas are delicate in the case of passing satellites and their limited visibility imposes the simultaneous use of three or four passing satellites so that at least one of them is visible to the transmitting or receiving location. If both the transmitting and receiving centers are visible from the satellite the link can be effected immediately. Otherwise the problem is more complicated. For these simple reasons, among others, links will be provided by means of a geostationary satellite which remains in fixed position with respect to the earth at a vertical distance of about 36,000 kilometers. At that altitude the earth is seen subtending an angle of 17 degrees and takes in about a quarter of the surface. Antennas which are more or less directional can be used on the satellite to communicate with a more or less large zone of the earth's surface seen from the satellite. The frequences used are high (from 7 to 20 gigahertz [GHz], for example), to allow use of directional antennas of small bulk, which can be installed on shipboard and whose positioning can be controlled. In practice the frequencies to be used are on the order of several gigahertz, or perhaps even 20 GHz.

However, let us note that in this case all the existing types of transmission--VLF, HF, and UHF--will remain for emergency use, with each ship having available only one or two transmitter-receivers of each type. But at that time antenna problems will be easily resolved and transmission will be a technique much easier to master.

Conclusion

At presnt a great part of information is being carried by HF waves, a frequency domain in which countermeasure problems are arising increasingly and are going to be added to those inherent in the use of these waves: significant coupling, multiple paths, antenna radiation difficulties, and so forth.

The safety of the ship, however, depends upon the security of transmission and great efforts must be devoted in the future in the direction of increasing reliability of the Navy's transmissions, in particular:

the number of radio apparatus is related to the operational role of ships and consequently it is not possible to reduce the number arbitrarily;

military transmission equipment cannot be compared with commercial radio receivers and are necessarily expensive;

installation of antennas constitutes the most difficult shipboard problem; it is frequently this installation which determines the structure of the transmission ensemble;

in the future individual apparatus will be replaced by computer controlled systems; more and more digital circuits will take the place of analog cicuits; and

last, in the more remote [sic] future (about 1980 for warships but undoubtedly before that for merchant ships) it is probable that information for the most part will be exchanged by means of satellites.

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